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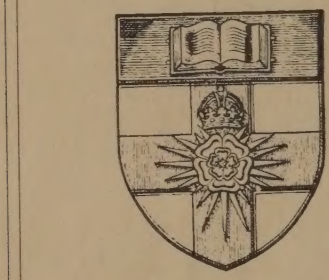

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THIRTY-FIVE VOLUMES.

—(18.)—

EDUCATION (SCIENCE AND ART DIRECTORY);
DUBLIN HOSPITALS;
ELECTRICAL COMMUNICATION WITH LIGHTHOUSES;
METEOROLOGY;
NATIONAL GALLERY; NATIONAL PORTRAIT GALLERY;
PATENT OFFICE;
WEIGHTS AND MEASURES;

Session

12 *March* 1894 —— 25 *August* 1894.

VOL. XXXIII.

1894.

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VOL. XXXIII.

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THIRTY-FIVE VOLUMES:—CONTENTS OF THE

EIGHTEENTH VOLUME.

N.B.—*THE* Figures *at the* beginning of the line, *correspond with the* N° *at the foot of each* Report; *and the* Figures *at the* end of the line *refer to the* MS. Paging *of the Volumes arranged for The House of Commons.*

EDUCATION (SCIENCE AND ART DIRECTORY):

[c. 7408.] Directory (Revised to June 1894), with Regulations for Establishing and Conducting Science and Art Schools and Classes. p. 1

DUBLIN HOSPITALS:

[c. 7448.] Thirty-sixth Report of the Board of Superintendence of Dublin Hospitals, with Appendices. 311

ELECTRICAL COMMUNICATION WITH LIGHTHOUSES, &c.:

[c. 7338.] Second Report of the Royal Commission appointed to inquire what Lighthouses and Light Vessels it is desirable to connect with the Telegraphic System of the United Kingdom by Electrical Communication. 367

ELECTRICAL STANDARDS:

[c. 7552.] Supplementary Report and Final Report of the Electrical Standards Committee. 377

NATIONAL PORTRAIT GALLERY:

[c. 7520.] Thirty-seventh Annual Report of the Trustees of the National Portrait Gallery, 1894. 391

PATENT OFFICE:

[c. 7386.] Eleventh Report of the Comptroller General of Patents, Designs, and Trade Marks, with Appendices, for the Year 1893. 403

NATIONAL GALLERY (IRELAND):

[c. 7506.] Report of the Director to the Board of Governors and Guardians of the National Gallery of Ireland, for the Year 1893. 425

WEIGHTS AND MEASURES:

254. Report by the Board of Trade on their Proceedings and Business under the Weights and Measures Acts, 1878 and 1889. 429

DEPARTMENT OF SCIENCE AND ART
OF THE COMMITTEE OF COUNCIL ON EDUCATION,
LONDON, S.W.

DIRECTORY,

(*Revised to June* 1894.)

WITH

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FOR

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CONTENTS.

Page

Staff of the Department of Science and Art - - - - iv
Summary of Grants - - - viii

REGULATIONS COMMON TO SCIENCE AND ART.

Parliamentary Vote for Instruction in Science and Art and its Administration - - - - 1
Nature of Aid granted towards Instruction in Science and Art - 2
Local Committees - - - 3
Premises, Fittings, Apparatus, and Examples - - - - 5
Building Grants - - 6
Teaching Staff and Meetings of class for Instruction - - - 6
Registration of Students - 7
Examinations:—
Their Nature - - - 7
Conduct of Examinations - 8
Arrangements for - - 8
Application for Examination Papers - - - 11
Custody of Examination Papers - 12
Re-examination - - - 13
Payments on Results of Examinations - - - - 13
Rewards to Students - - - 15
Local Science and Art Scholarships and Exhibitions - - - 15
Inspections - - - - 18
Grants and Privileges allowed to Teachers - - - - 18
Free Admissions to Libraries and Museums - - - - 18
Grants and Loans to Schools, Museums, &c. - - - - 18, 19
Technical Instruction - - 22

REGULATIONS SPECIAL TO SCIENCE.

List of Subjects - - - 23
Premises, Fittings, and Apparatus - 24
Building Grants - - - 24
Qualification of Teachers - - 24
Registration of Students - - 26

Page

Examinations - - - 26
Time Table - - - 27
In Practical Chemistry and Metallurgy - - - 28
Practical, in Honours - - 29
Pupils of Elementary Schools - 29
(Special) Navigation Schools - 29
Conduct of - - - 30
Payments on Results - - 30
Organized Science Schools - - 33
Rewards to Students - - - 36
Cards, Certificates, Prizes, and Medals - - - 36
Royal Exhibitions, National Scholarships, and Free Studentships - - - 37
Whitworth Scholarships - 39
Grants and Privileges allowed to Teachers - - - - 39
Summer Courses of Instruction - 39
Studentships in Training - 39
Travelling Allowance - - 39
Assisted Studentships at Provincial Colleges - - - 39
Visits to Museum - - 40
Admission to Lectures - - 40
Prospectus of Royal College of Science, London - - - 41
Regulations for Science Classes in Training Colleges - - - 50
Regulations for Science Classes in Day Training Colleges - 54
Special Regulations for Schools and Teachers in Ireland - - 56

REGULATIONS SPECIAL TO ART.

PART I.

Subjects of Instruction - - 60
Premises, Fittings, Apparatus, and Examples - - - - 62
Building Grants - - - 62
Teaching Staff and Times of Meeting for Instruction - - - 62
Branch Classes - - - 63
Qualification of Teachers - 63
Art Certificates - - - 63
Elementary Drawing Certificate - - - 64
Art Class Teacher's Certificate 64
Art Master's Certificates - 65
Regulations as to students - - 68
Registration - - - 68

	Page
Examinations	69
Time Table	69
Examination in Modelling	70
Examination of Works sent to South Kensington	71
Payments on Results	73
Rewards to Students	74
National Competition Works	75
Prizes	75
Medals	75
Free Studentships	76
Local Scholarships, Royal Exhibitions, and National Scholarships	76
Princess of Wales's Scholarships	79
Grants and Privileges allowed to Masters, &c.	79
Summer Courses of Instruction	79
Prospectus of National Art Training School	80
Part II.	
Grants for Drawing in Elementary Schools (Form No. 1294)	86
Dates of Examination	88
Standards of Examination	88
Special Classification of Scholars	88
Amount of Grant	90
Cards of Merit	90
Examination of Pupil-teachers and Ex-Standard (Code) Scholars	91
Grants for Drawing in Evening Continuation Schools; and Syllabus	92
Grants for Manual Instruction in Elementary Schools and Organised Science Schools	97
Part III.	
Aid to Training Colleges for Teachers	99
Examinations	99
Rules as to Candidates	99
Payments on Results	100
Training Colleges in Ireland	100
Appendix A.	
Forms and Instructions for guidance in establishing and maintaining Schools and Classes	101
Forms common to Science and Art.	
Form No. 170 (Memoranda for Use of Committees)	101
Form No. 88 (Formation of Local Committee)	106
Form No. 1069 (Instructions for keeping Registers)	110
Form No. 555 (Building Grant Regulations)	113
Technical Instruction Act, 1889	116
Technical Instruction Act, 1891	118
Appendix B.	
Forms special to Science.	
Form No. 802B (Regulations as to the Circulation of Apparatus, &c.)	120
Form No. 1284 (Indispensable Apparatus)	121
Form No. 91 (Rules for Examinations)	127
Form No. 51 (Claim for Payment)	132
Appendix C.	
Forms special to Art.	
Form No. 965C (Rules for Conducting Art Examinations)	135
Form 526, Claim for Payments	141
Appendix D.	
Syllabus of the Science Subjects in which Examinations are held by the Department	145
Appendix E.	
Syllabus of the Art Subjects in which Examinations are held by the Department	263
Additional Art Masters' Certificates	288
Index	292
List of Publications issued by the authority of the Department, at end of Index.	

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Directors (*Science Museum*).—Major-General E. R. Festing, F.R.S. (late R.E.); (*Art Museum*) J. H. Middleton, Litt.D., D.C.L., F.S.A.

Assistant Director.—C. Purdon Clarke, C.I.E., F.S.A.

Museum Keepers.—A. C. King, F.S.A.; W. I. Last; W. H. J. Weale; A. B. Skinner, B.A.; H. M. Cundall, F.S.A.; H. E. Acton; C. H. Derry, B.A.; (*Resident Officer in charge of Bethnal Green Branch Museum*).

Assistant Museum Keepers.—J. Barrett, B.A.; W. W. Watts; G. H. Palmer; A. F. Kendrick; T. A. Lehfeldt; T. F. Parkinson; S. Wood; C. H. Wylde.

Junior Assistants.—R. F. Martin; W. R. Swain, B.Sc.; L. W. Fulcher, B.Sc.; T. C. Grove; E. W. Dennis; E. F. Strange; C. E. Palmer; P. G. Trendell.

Special and Technical Assistants.—A. Reid; W. G. Johnson; W. T. Key; W. J. Hill; F. P. Macaulife; F. G. M. Beaumont; C. Stanley Clarke; E. R. J. Williams.

GEOLOGICAL SURVEY.

Director-General.—Sir Archibald Geikie, D.Sc., LL.D., F.R.S.

Director for Great Britain.—H. H. Howell.

District Surveyor.—W. Whitaker, B.A., F.R.S.

Geologists on the English Survey.—W. Topley, F.R.S.; R. H. Tiddeman, M.A.; H. B. Woodward; C. E. Fox-Strangways; J. J. H. Teall, M.A., F.R.S.; W. A. E. Ussher; A. C. G. Cameron.

Assistant Geologists.—C. E. De Rance; F. J. Bennett; J. H. Blake; C. E. Hawkins; Clement Reid.

Temporary Assistant Geologists.—A. J. Jukes Brown, B.A.; Aubrey Strahan, M.A.; W. W. Watts, M.A.; G. W. Lamplugh; W. Gibson.

Curators and Palæontologists.—G. Sharman; E. T. Newton, F.R.S.

Assistant in the Fossil Department.—H. A. Allen.

Fossil Collector.—J. Rhodes.

General Assistant.—Henry J. Gray.

SURVEY OF SCOTLAND.

Director.—H. H. Howell.

District Surveyor.—B. N. Peach, F.R.S.

Geologists.—J. R. Dakyns, M.A.; John Horne, F.R.S.E.; W. Gunn; Hugh Miller; R. G. Symes, M.A.; B. S. N. Wilkinson.

Temporary Assistant Geologists.—C. T. Clough, M.A.; J. S. Grant Wilson; G. Barrow; Lionel W. Hinxman, B.A.; J. B. Hill; E. Greenly.

Curator of Geological Collections, Edinburgh Museum.—J. G. Goodchild.

Assistant in the Fossil Department.—A. Macconochie.

Fossil Collector.—J. Bennie.

General Assistant.—Robert Lunn.

SURVEY OF IRELAND.

Senior Geologist.—J. Nolan, M.R.I.A.

Geologists.—F. W. Egan, B.A.; J. R. Kilroe; Alexander McHenry, M.R.I.A.

Temporary Assistant Geologist.—W. J. Sollas, D.Sc., M.A., F.R.S.

Assistant in the Fossil Department.—Richard Clark.

MUSEUM OF PRACTICAL GEOLOGY, JERMYN STREET.

Director.—Sir A. Geikie, D.Sc., LL.D., F.R.S.

Registrar, Curator, and Librarian.—F. W. Rudler.

Assistant (to Curator).—A. Pringle, M.A., B.Sc.

Assistant Librarian.—T. W. Newton.

EDINBURGH MUSEUM OF SCIENCE AND ART.

Director.—Maj.-Gen. Sir R. Murdoch Smith, K.C.M.G. (late) R.E.

Keeper of Natural History Collections.—Prof. R. H. Traquair, M.D., F.R.S.

Curator.—D. J. Vullance.

Assistant in Natural History Museum.—W. Eagle Clarke.

Junior Assistant.—P. H. Grimshaw.

Assistants in Industrial Museum.—W. Clark; C. N. B. Muston; T. W. Nash.

Clerks.—A. B. Steele; W. Bell.

SCIENCE AND ART MUSEUM, NATIONAL LIBRARY, SCHOOL OF ART, AND ROYAL BOTANIC GARDENS, DUBLIN.

Visitors of the Science and Art Museum and Royal Botanic Gardens.—Lord Ardilaun, D.L., *President*; The Viscount Powerscourt, K.P., D.L.; The Earl of Rosse, K.P., F.R.S.; J. K. Ingram, Esq., LL.D., S.F.T.C.D.; Professor E. P. Wright, M.D., J.P.; Rev. S. Haughton, M.D., D.C.L., F.R.S., S.F.T.C.D.; J. R. Garstin, Esq., D.L., F.S.A.; C. Uniacke Townshend, Esq., J.P.; Samuel F. Adair, Esq., J.P.; Hon. Judge Boyd, LL.D.; J. C. Meredith, Esq., LL.D.; Sir Howard Grubb, F.R.S.

Trustees of the National Library of Ireland.—Very Rev. Monsignor Molloy, D.D., D.Sc.; J. T. Gilbert, Esq., LL.D., F.S.A., M.R.I.A.; Arthur Vicars, Esq., Ulster, F.S.A.; Professor E. P. Wright, M.D., J.P.; J. K. Ingram, Esq., LL.D., S.F.T.C.D.; John Joly, Esq., M.A., D.Sc., F.R.S.; Prof. Edw. Dowden, LL.D.; Lieut.-Colonel A. V. Davoren, J.P.; Rev. Geo. T. Stokes, D.D.; Hon. Judge Boyd, LL.D.; Professor D. J. Cunningham, M.D., F.R.S.; Professor J. Mallet Purser, M.D., D.Sc.

General Administration.

Director.—V. Ball, C.B., M.A., F.R.S.
Chief Clerk.—H. B. White, M.A., C.E.
Clerk of Accounts.—C. W. Steele.
Clerk and Registrar.—G. S. Watts.

Science and Art Museum.

Keeper, Natural History Museum.—R. F. Scharff, Ph.D., B.Sc.
Assistants in Natural History Museum.—A. R. Nichols, B.A., M.R.I.A.; G. H. Carpenter, B.Sc.
Keeper, Art and Industrial Museum.—T. H. Longfield, M.R.I.A., F.S.A.
Assistants in Art and Industrial Museum.—J. J. Buckley; E. P. Alabaster.
Keeper of Herbarium.—T. Johnson, D.Sc.
Technical Assistants.—R. Pride; A. Mc Googan.
Museum of Irish Antiquities. Keeper.—Major MacEniry.

National Library of Ireland.

Librarian.—W. Archer, F.R.S., M.R.I.A.
Assistant Librarian.—T. W. Lyster, M.A.; R. L. Praeger, B.A.

Royal Botanic Gardens.

Keeper.—F. W. Moore, M.R.I.A.

Metropolitan School of Art.

Head Master.—James Brenan, R.H.A.
Assistant Master.—F. Luke.
Principal Mistress.—Miss M. Julyan.
Instructor in Modelling.—
Assistants.—M. J. Buckley (*Mechanical Drawing*); Mrs. Barden; J. T. Miles; Miss Jacob.
Occasional Lecturers.—Prof. Alexander Fraser, M.B., *Artistic Anatomy*; Sir T. N. Deane, R.H.A., F.R.I.B.A., *Architecture.*

ROYAL COLLEGE OF SCIENCE, DUBLIN.

Dean of Faculty, Session 1893-94.—W. F. Barrett, F.R.S.E., M.R.I.A.
Secretary.—J. P. O'Reilly, C.E., M.R.I.A.
Clerk, (Second Division).—C. J. Bateman.

Professors.

Physics.—W. F. Barrett, F.R.S.E., M.R.I.A.
Chemistry.—W. N. Hartley, F.R.S., F.C.S., F.R.S.E.
Geology.—G. A. J. Cole, F.G.S.
Applied Mathematics and Mechanism.—W. McFadden Orr, M.A.
Botany.—T. Johnson, D.Sc., F.L.S.
Zoology.—A. C. Haddon, M.A., F.Z.S., M.R.I.A.
Descriptive Geometry, Engineering, and Mechanical Drawing.—J. Lyon, M.A.
Mining and Mineralogy.—J. P. O'Reilly, C.E., M.R.I.A.
Assistant to Professor of Physics.—W. Brown.
Assistant Chemist.—Hugh Ramage, A.I.C.
Assistant in Descriptive Geometry and Engineering (Assistant in Drawing School).—J. Taylor.
Assistant in Zoology and Botany (also Demonstrator in Palæontology).—J. E. Duerden, As., N.S.S.C.
Demonstrator for Chemistry and Assaying.—E. V. Clarke.
Demonstrator in Applied Mathematics.—J. P. Johnston.

ROYAL HIBERNIAN ACADEMY.

Secretary.—S. C. Smith, R.H.A.

SUMMARY OF PRINCIPAL GRANTS.

Science.	Art.

To Science and Art Schools and Classes.

I. Payments to the Local Committees of Schools and Classes on the results of instruction, as tested by Examination, of Students of the Industrial Classes.

Science.	Art.
(*a.*) 2*l.* for a pass in the Elementary Stage, and 5*l.* and 2*l.* 10*s.* for a 1st and 2nd class respectively in the Advanced Stage of each subject except mathematics, for which see detailed scale at p. 30.	(*a.*) 1*l.* and 10*s.* for a 1st and 2nd class respectively in the Elementary Stage; and 3*l.*, 2*l.*, and 1*l.* for excellent 1st and 2nd class respectively in the Advanced Stage, and for subjects in which there is no Elementary Stage; and 6*l.* and 3*l.* for 1st and 2nd class respectively in Honours.
(*b.*) 3*l.* and 4*l.* for a 1st and 2nd Class respectively in Honours.	(*b.*) 3*l.* or less per student for works executed in local classes.
(*c.*) In Practical Chemistry and Practical Metallurgy 3*l.* for a pass in the Elementary Stage, 6*l.* and 3*l.* 10*s.* in the Advanced Stage.	(*c.*) 3*l.* for a student obtaining a Free Studentship or Local Scholarship.
(*d.*) 10*s.* for passing in Section I. (Geometrical Drawing) of the Elementary Stage of Practical Plane and Solid Geometry.	(*d.*) 15*l.* each for not more than two Art Pupil Teachers.
	(*e.*) 5*l.* for each student who obtains a National Scholarship or a Royal Exhibition, or who obtains admission to Training Class.

II. Prizes and medals are awarded to candidates.

Science.	Art.
(*a.*) Prizes to students successful in competition in the Advanced Stage of each subject and bronze medals to those obtaining a 1st Class in Honours. Certificates or cards to all successful candidates.	(*a.*) A few Queen's prizes to students who do best in the Examinations; and Gold, Silver, and Bronze Medals, and other prizes of Books, for the best works submitted in the National Competition of works of all the Schools of Art and Art Classes.

III. Science and Art Scholarships for Students of the Industrial Class, held locally, 4*l.*, 7*l.*, and 10*l.*, for the 1st, 2nd, and 3rd year respectively, on condition that a local contribution of 5*l.* a year is made. 60 Local Scholarships held at any School of Art (20 awarded each year) with maintenance allowance of 20*l.* a year and tenable for three years.

IV. Local Exhibitions, to be held by Students of the Industrial Classes at the Royal College of Science or the National Art Training School—London, the Royal College of Science, or the School of Art, Dublin, or at an approved Provincial Science College or School of Art, 25*l.* to meet an equal sum locally raised.

V. Grants for Buildings, Fittings, and Apparatus.

Science.	Art.
(*a.*) Not exceeding 2*s.* 6*d.* per square foot of internal area, or one half the amount provided either by voluntary contributions or by local rate, raised under the Technical Instruction Act or the Public Libraries Acts, or by both; up to a maximum of 500*l.* for buildings.	(*a.*) Not exceeding 2*s.* 6*d.* per square foot of internal area up to a maximum of 500*l.* for buildings.

(*b.*) Grants towards the purchase of apparatus, examples, and fittings are suspended, except in Ireland, while the Local Taxation (Customs and Excise) Act, 1890, continues in force.

VI. Special Grants to Organized Science Schools in addition to the foregoing, 20*s.* and 10*s.* respectively for each student who attends a day or an evening school not less than 250 or 60 times in the year and passes the specified examination.

Science.	Art.

VII. Aid to Students in attending the Royal College of Science, London, the National Art Training School, London, and the Royal College of Science, Dublin.

(*a.*) 21 Royal Exhibitions (seven awarded each year) with maintenance allowance of 50*l.* a year tenable for three years.

(*b.*) 66 National Scholarships (twenty-two awarded each year) with maintenance allowance of 30*s.* a week for 40 weeks in the year tenable for three years.

(*c.*) 18 Free Studentships (six awarded each year) tenable for three years, at Royal College of Science, London.

(*a.*) 16 National Scholarships (eight open each year) tenable for not more than three years at National Art Training School with maintenance allowance of 25*s.* a week for 42 weeks in the year.

(*b.*) 30 Royal Exhibitions (10 awarded each year) with maintenance allowance of 25*s.* a week for 42 weeks in the year, tenable for three years.

(*c.*) Free Studentships in National Art Training School.

VIII. Aid to teachers and persons preparing to become teachers in attending the Royal College of Science and the National Art Training School, London, the Royal College of Science and School of Art, Dublin, and Provincial Colleges at which advanced instruction in Science is given.

(*a.*) Grants of 3*l.* each with travelling expenses to local teachers selected to attend short courses of instruction at Royal College of Science.

(*b.*) Grants of 21*s.* a week each with travelling expenses to teachers in training selected to attend the sessional courses of the Royal College of Science.

(*c.*) Grants in aid of fees to local teachers selected to attend Provincial Science Colleges.

(*d.*) Free admission (subject to payment of examination fee) to courses of lectures at Royal College of Science to Science teachers.

(*a.*) Grants to enable masters and students to visit various metropolitan Art Institutions, and, in special cases, foreign towns, schools, and galleries.

(*b.*) Grants of 3*l.* each with travelling expenses to local teachers and students selected to attend short courses of instruction at National Art Training School and South Kensington Museum.

(*c.*) Grants of from 12*s.* 6*d.* to 43*s.* 6*d.* a week for 42 weeks in the year with travelling expenses to students selected to attend the National Art Training School as Students in Training.

To Local Museums.

IX. Grants to Local Museums and Loans of works of Science and Art, Books, and specimen sets of teaching Apparatus to Local Museums, Temporary Exhibitions, and Science and Art Schools.

To Training Colleges.

X. Aid to Training Colleges for Instruction in Science and Art.

Grants on results of the Examination in November or December on the scale stated at p. 51.

Grants of 15*s.* and 7*s.* 6*d.* in respect of successes at the October Art Examinations for students at Residential Training Colleges and similar payments in respect of successes at the May Examinations for students at Day Training Colleges in each subject a resident student passes.

To Elementary Schools.

XI. Aid to Elementary Schools for Instruction in Drawing and Manual Instruction.

(*a.*) Grants of 1*s.*, 1*s.* 6*d.*, or 2*s.* on average attendance of Schools examined in Drawing.

(*b.*) Grants of 1*l.* and 10*s.* for a 1st and 2nd class, respectively, in the Elementary Stages of Freehand, Model and Perspective Drawing and Shading from the Cast; and 10*s.* for a pass in Geometrical Drawing.

(*c.*) Grants, for Manual Instruction, of 2*d.* a lesson—with the addition of 20 per cent. if the instruction is "Excellent."

(*d.*) Grants of 1*s.*, 1*s.* 6*d.*, or 2*s.* to Evening Continuation Schools for each Scholar taught Drawing.

For Technical Instruction.

In Ireland the sum of money in aid of Technical Instruction contributed from the rates by a Local Authority is supplemented by a grant from the Department of a similar amount.

SCIENCE AND ART DIRECTORY,

Containing the Rules and Regulations under which Aid to Science Schools and Art and Technical Schools and Art Classes is administered. The principal alterations made since the last edition of the Science and Art Directory are printed in italics.

CHAPTER I.

REGULATIONS COMMON TO SCIENCE AND ART.

Parliamentary vote.

I. A sum of money is voted annually by Parliament for instruction in Science and Art in the United Kingdom, and is administered by the Department of Science and Art.

Constitution of Department.

II. The head of the Department of Science and Art is the Lord President of the Council, assisted by a member of the Privy Council, who is called the Vice-President of the Committee on Education, and who acts under the direction of the Lord President, and for him in his absence. (Order in Council, 25th February 1856, Act 19 & 20 Vict. c. 116.)

Object of the grant.

III. The object of the vote is to promote instruction in Science and Art, especially among the industrial classes. The Vote is applied—

(*a.*) to the maintenance of the Science and Art Museums at South Kensington, in Dublin, and in Edinburgh; of the Royal College of Science and the National Art Training School at South Kensington; of the Royal College of Science and Metropolitan School of Art in Dublin; and of the Geological Survey of the United Kingdom and the Geological Museum in Jermyn Street;

(*b.*) in grants for Drawing and Manual Instruction in Elementary Schools; and

(*c.*) to aid in the establishment and maintenance of Science and Art schools and classes; of local Museums of Science and Art; and in Ireland of Technical Schools.

The rules under which aid is given to Science and Art Schools and Classes and to local Museums are as follows; those under which aid is given for Drawing and Manual Instruction in Elementary Schools will be found at pp. 86 and 92.

NATURE OF AID.

Nature of assistance.

IV. The subjects of Science towards instruction in which aid is given are specified at p. 23, and those of Art at p. 60. This aid is granted in the form of—

(*a.*) Payments to the Committees of Schools and Classes on the results of instruction, and certificates, prizes, medals, free Studentships, Scholarships, and Exhibitions to the Students.

(*b.*) Building Grants: and, in Ireland, Grants towards the purchase of apparatus, examples, fittings, &c.

(*c.*) The maintenance and instruction of teachers and students attending the Royal College of Science and the National Art Training School, South Kensington; the Royal College of Science, Dublin; and other approved centres.

(*d.*) Loans and grants to Local Museums and to Science and Art Schools.

(*e.*) Payments to Training Colleges for instruction in Science and in Art.

(*f.*) Grants for Technical Instruction in Ireland.

Conditions of aid.

V. Aid is only granted to Schools and Classes which have been approved by the Department, and are open at all times to the visit and inspection of its officers.

Forfeiture of grant.

VI. Grants may be withheld wholly or in part for any breach of the rules, or if the instruction or supervision is inefficient. The Department is the sole judge as respects all grants and awards, and its decision is final and conclusive.

Alteration in grant.

VII. The vote for Science and Art instruction is liable to be decreased and eventually discontinued. Its grants, which are intended to supplement and not to supersede local effort, must, therefore, not be looked upon as perpetual, or as in any way establishing a claim to any payments beyond those offered from time to time.

Management and local support.

VIII. Every School or Class must be under the superintendence and management of a local Committee, who are responsible for the engagement, employment, and payment of the teacher or teachers, and for all other

expenses connected with it. It must not be conducted for private profit or farmed out by the Managers to the Teacher; and it must have local support either in the form of fees and subscriptions or of rates. Grants cannot be made for Science or Art Classes in buildings which are not public institutions, unless such classes are held in the evening, and are open to the public.

Gratuitous instruction is only permitted where the school or class is supported by a local rate; or where considerable local contributions have been made to secure free instruction; or where classes have been but recently established, and it can be shown to the satisfaction of the Department that the circumstances of the locality justify such a course. No school or class will be permitted to charge abnormally low fees in order to compete with the others in the same locality. The Committees of Schools or Classes in a district should, therefore, consider the subject together, and fix some minimum fee for the district.

Students in a Training College; teachers, and pupil teachers, and holders of scholarships, exhibitions, and studentships, may be exempted from the payment of fees.

Forms obtainable.

*** Copies of any of the forms mentioned in this Directory will be supplied on application, personally or by letter, addressed to "The Secretary, Science and Art Department, London, S.W." The Department does not undertake to send them to Science and Art Schools and Classes in the absence of a special application in each case. The transmission of forms does not imply the recognition of the School or Class by the Department (*see* Form No. 170, page 101).

LOCAL COMMITTEES.

Local Committee.

IX. The Local Committee must consist of a Chairman, Secretary, and at least three other members. The offices of Chairman and Secretary cannot be held by the same person. The Department corresponds, as a rule, with the Secretary alone, and he is required to sign all communications from the School.

The Committee may be—

Constitution of Local Committee.

(1.) The Local Authority under the Technical Instruction Act, or the Committee to which it has delegated its powers under that Act; or a School Board; or the governing body of a School, not being a public elementary school, with a scheme under the Endowed Schools Acts or the City of London Parochial Charities Act; or

(2.) A Committee formed for the special purpose of superintending and managing the School or Class under the Department.

If a Local Authority, School Board, or Board of Governors desire to act as the Local Committee of a

School for which they are responsible they must pass a resolution to that effect. This resolution, with the names and addresses of the members, must be transmitted to the Department and will remain in force until rescinded. All changes in the constitution of the Local Committee must be reported as they occur.

A Local Authority (or the Committee to which it delegates its authority under the Technical Instruction Act, 1889) or a School Board may appoint a Committee consisting wholly or partly of members of their body, and may delegate the duties of superintendence and management of the School to such Committee, provided that the members of this Committee who are not members of the Local Authority or of the School Board are such persons as would be eligible to act on a Committee under section (*a.*) below.

In other Schools or Classes, or where the Local Authority, School Board, or Board of Governors do not act in their corporate capacity as the Local Committee for a School or Class, the Committee to superintend and manage it must comply with the following conditions :—

Committee to consist of at least five members.

(*a.*) All the members of the Committee must be well-known responsible persons of independent position, who have no personal interest in the teachers of the school. The following are not eligible to be members of the Committee :—Candidates for examination by the Department or their Teachers in any subjects; relatives of Teachers under the Department; Teachers of Schools which have candidates for examination; and Teachers of Schools receiving Government Grants. A member of Committee must not take any part in an examination at which a relative of his is a candidate.

Chairman and at least one other member must be of position defined.

(*b.*) As many persons as possible in recognised positions of public responsibility in the district, such as mayors, provosts, town or county councillors, magistrates, members of school boards, trustees of grammar schools, clergymen of the Established Church in parochial employment, and ministers of religion in charge of legally recognised places of public worship, should be on the Committee. It is absolutely necessary that at least two such responsible persons should undertake to act on it. The Chairman, who will be required to certify that the constitution of the Committee is in accordance with the foregoing requirements, must be in a position of public responsibility as defined above.

Formation of Local Committee.

(*c.*) The proposed members of a Local Committee must sign Form No. 88. No one can act on a Committee, or assist in the conduct of an examination, whose membership has not been previously approved by the Department.

Renewal of Committee.

(*d.*) When a School or Class is first formed, the Form No. 88 must be signed at a general meeting of the Committee. If the same Committee continue to act the next year, it will only be necessary to fill up Form No. 168 at a meeting of the Committee. New members who are added to an existing Committee during the progress of a session should sign Form No. 88*b*.

New members.

(*e.*) A Local Committee may, with the sanction of the Department, supervise classes meeting in different places, but the Department will not recognise more than one Committee—except in the case of a Local Authority acting as such—for the supervision of instruction given in any one building. One Committee recognised for a building.

X. In order that a School or Class may be placed on the list of those eligible for grants the Committee must have been formed, or renewed, by the 31st October preceding the examination. When the Committee is approved the School or Class will be assigned a distinguishing "School Number," which must be quoted on all forms and correspondence. Department's approval of Committee.

(*a.*) A Committee which is formed under § IX., section 1, must transmit a certified copy of the resolution by which it is constituted.

(*b.*) A Committee which is formed under § IX., section 2, must forward Form No. 88 or, on renewal, Form No. 168.

(*c.*) A Committee which has been recognised by the Department continuously for three years, or a Committee formed by resolution, is not required to send in a renewal form year by year, but will be considered as continuing in office so long as it discharges its duties efficiently, or until the Department is informed that the members desire to relinquish their duties. The Secretary of the Committee should, however, report all changes in its constitution, and, in the case of a Committee formed under § IX., section 2, he should submit on Form No. 88B the signatures of new members, duly certified by the Chairman. Any alterations required by the Department must be completed by the 31st January preceding the examination (*see* Form No. 170, p. 102). Permanent Committees.

(*d.*) A table of memoranda for the use of Secretaries and Members of Local Committees will be found in Form No. 170, p. 101. Table of duties.

(*e.*) A deduction of half-a-crown is made from the next payments to the School for every day's delay in sending in a Form or a Return after the appointed date. Deductions for neglect.

XI. A Committee may be formed to provide for the examination of candidates on account of whose success neither payments nor prizes are to be claimed. Such a Committee should sign Form No. 88*c*, which must be sent to the Department before the 1st January preceding the examination for which application is to be made. Committee for conducting an examination only.

This Committee cannot be renewed by sending Form No. 168, but must be reconstituted from year to year.

PREMISES, FITTINGS, APPARATUS, AND EXAMPLES.

XII. That portion of the income of a School which is derived from instruction in Science or in Art must be applied wholly for the purposes of such instruction, and the Local Committee must provide and maintain suitable rooms for the instruction and for the examinations, with firing, lighting, apparatus (*see* Form No. 1284, p. 121), examples, &c. If at any time it appears that these are

unsatisfactory or insufficient, the assistance of the Department may be reduced or withdrawn.

The managers of an Elementary School under the inspection of the Education Department may allow the use of their premises for a Science School or Art Class, provided that the arrangement be not allowed to interfere injuriously with the primary purposes of such Elementary School (*see* sec. 11, p. 29).

Building Grants.

Building Grants.

XIII. A grant in aid of a new building, or for the adaptation of an existing building, for a School of Science or for a School of Art, may be made under conditions which are stated at p. 113.

The sum allocated to the payment of Building Grants will not exceed 10,000*l. in any year; applications will therefore be considered in their order of receipt.*

The application for a Grant, which will become payable out of the Parliamentary Vote for any year must be sent in on or before the 1st November in the preceding year.

Grants for apparatus.

N.B.—Grants for fittings, apparatus, and examples are suspended, except in Ireland, while the Local Taxation (Customs and Excise) Act, 1890, continues in force.

The conditions under which they are made in Ireland are contained in Form No. 48, which can be obtained on application.

TEACHING STAFF AND MEETINGS OF CLASS FOR INSTRUCTION.

Qualification of teachers.

XIV. In order to claim payments on results and prizes, the Teacher of a School or Class must be qualified in accordance with the rules laid down at pp. 24 to 26 for instruction in Science, and at pp. 63 to 68 for instruction in Art.

Number of lessons necessary.

XV. The class in each subject of Science, or group of subjects of Art, must meet under the instruction of a qualified teacher on at least 28 days during the session, each meeting being of at least one hour's duration on a separate day (*see* sec. 6, p. 26): and the instruction of all students upon whose examination a payment is to be claimed must commence within reasonable time after the 1st October preceding the examination on which payments on results are claimed and continue until the examination.

Should the instruction not commence and continue as above stated, or should less than 28 lessons have been given during the session the claim for payment on results will only be considered under very exceptional circumstances, and payments, if made at all, will be proportionately reduced.

Return on Form No. 120.

XVI. Every School or Class must, on its formation and annually before the 1st October, make a return on Form No. 120 of its Teaching Staff, with the Time Table of instruction for the current session; of its sources of

maintenance; and, in the case of an old School or Class, of the statistics for the past session.

a. If Form No. 120 be not received before 1st October, the Department may refuse to make payments on the results of the next examination. The acceptance of Form No. 120 after that date will be exceptional, and subject to a deduction from the grant. — Return a condition of payment.

b. The arrangements for the session returned on Form No. 120 are not necessarily final, but they must be adhered to until a letter intimating intended alterations has been sent to the Department and its receipt has been acknowledged. — Alterations to be reported.

c. Those lessons only which are given on the days and between hours previously reported to the Department, and which are given by teachers of whose appointment it has approved, and in the buildings which it has recognized for the meetings of the class, can be registered towards the number necessary for prizes or for payments on results. — Lessons to be in accordance with return.

Registration of Students.

XVII. A general register must be kept in accordance with the instructions in Form No. 1069 (*see* p. 110) for each Science or Art School or Class, and an attendance register for each subject taught. The Committee are responsible for the accuracy of the registration, and no grants will be made or prizes allowed unless the registers are properly kept and certified. A member of the Committee visiting the school should record, in the space provided in the attendance register, the number of students who are present at the time of his visit, and should certify the entry with his signature and the date. — Registers. — Visits of members of Committee.

A Committee which makes no claim for payments on results is not required to keep a general register.

EXAMINATIONS.

XVIII. These are of two kinds: (*a*) The Personal Examinations of Students, and (*b*) The Examination of the Works executed by the students in the class during the session. — Nature of Examinations.

The Personal Examinations of students in Science and Art Schools and Classes are held annually about May and of Training Colleges about October and December. The May examinations are open to external candidates. The subjects of the Personal Examinations in Science are stated at pp. 23 and 27, and in Art at pp. 69, 70, and 71.*

* It will be observed that on the 4th, 6th, 7th, 8th, 9th, 10th, 11th, 13th, 14th, 15th, 16th, 17th, 18th, 20th, 21st, 22nd, 23rd, 24th, 27th, 28th May, examinations in Science and in Art are held in whole or in part during the same hours. No candidate can, on any one of those dates, be examined in a subject of Science and also in a subject of Art the hours for which overlap.

For Navigation Schools additional examinations may also be held twice a year (*see* p. 29).

The EXAMINATION OF WORKS commences in April. The works are sent to the Department for that purpose. The details with regard to this examination are stated at p. 71.

CONDUCT OF EXAMINATIONS.

Who may act as Superintendents.

Number of Superintendents required.

Superintendents may relieve each other.

XIX. The examinations are conducted by Superintendents, who must be either members of approved local committees (§ IX.) or Special Local Secretaries and their assistants (§§ XXII. and XXIII.). Two Superintendents at least must be present in each room throughout the examination; and when there are more than 50 candidates in any room there must be an additional Superintendent for every additional 50, or fraction of 50, candidates. In the case of examinations conducted by Local Committees, superintendents may relieve one another, provided that the required number be always present. If the requisite number of Superintendents be not present at any period of the examination it cannot be accepted.

Attendance of Committee to identify students.

Member of Committee supplying place of Special Local Secretary or Assistant.

XX. When a Special Local Secretary has been appointed, members of the local committees within his district are relieved of the responsibility of conducting the examinations, but some of them should attend during a portion of each evening on which their school is examined in order to identify their own students; and to provide against the examination of their class failing from accidental circumstances. In case of the unavoidable absence of the Special Local Secretary, or his assistant, a member of the Committee should take his place.

For further detailed Rules, *see*, as respects Science, p. 127, and as respects Art, p. 135.

ARRANGEMENTS FOR LOCAL EXAMINATIONS.

XXI. If two or more Schools in the same town, or within a reasonable distance of one another are to be examined, a general examination committee must be formed, by the amalgamation of the several Local Committees, to hold the examinations at some common centre or centres with an Examination Secretary, who must be a member of one of the Local Committees.

It is only when the local circumstances render an amalgamation of the Committees impracticable or undesirable that it will not be insisted upon.

When there are less than four candidates for examination in one place the Department may require them to go to a neighbouring centre.

The amalgamation of committees does not imply the appointment of a Special Local Secretary as provided for in § XXII.

Where an amalgamated examination is held, each Committee must furnish the Examination Secretary, or, if there be one, the Special Local Secretary, before the 16th of March, with a list of the names of the candidates for examination from the school which they superintend, and a statement of the subjects in which each candidate proposes to be examined. The Examination Secretary, or the Special Local Secretary, should refuse to provide accommodation for any candidate whose name has not been returned to him before he transmits the Application Form No. 119 to the Department. *See also* § XXVI.

Special Local Secretaries.

XXII. In large towns or populous districts where there are several Schools or Classes, and where numerous examinations are to be held, or where a large and important School is to be examined in a number of subjects, the Department may, on the application of the Local Committees, authorise the appointment—or if it should seem necessary, require the appointment—of a Special Local Secretary to manage the whole business of the examination.

Local Committees who wish to nominate a Special Local Secretary for the town or district in which they are situated should apply to the Department before the 10th February. When a Special Local Secretary has been appointed the Department corresponds with him alone on all subjects connected with the examination. He must arrange for holding the examinations at convenient centres, subject to the approval of the Department; the number of these centres being as few as possible. He is allowed a fee of half a guinea (*a*) for each night on which an examination in either Science or Art, or in both, is to be held; (*b*) for each afternoon of examination in Practical Chemistry or Practical Metallurgy; and (*c*) for three hours' attendance at each of the Art examinations held in the day time or afternoon. He is also allowed a fee of half a guinea for every seventy-five papers worked at the examinations.

Assistants for Special Local Secretary.

XXIII. Assistants will be appointed to help the Special Local Secretary. The number of assistants required will depend upon circumstances, and will be fixed by the Special Local Secretary, subject to the approval of the Department.

Each of the assistants will receive a fee of half a guinea for each night of examination, and for each afternoon of examination in Practical Chemistry or Practical Metallurgy on which he may

be required to be present and for each three hours' attendance at the Art examinations held in the day time or afternoon.

The Special Local Secretary may act in the place of an assistant on any night on which there is an examination at but one centre. Otherwise, as he is charged with the general supervision of the examinations, he is not to act in the place of an assistant except in the case of an emergency.

When the Special Local Secretary acts as an assistant, he will receive no additional fee.

Nomination and appointment of Special Local Secretary.

XXIV. The nomination of a Special Local Secretary rests with the Special Committee of the Local Committees, and the nomination of his Assistants with the Special Local Secretary.

When Local Committees are asked to nominate a Special Local Secretary, a Special Committee of the several chairmen, or an equal number of representatives from each Committee, should be formed for the purpose. The meeting, of which at least one week's notice should be given, will, as a rule, be convened by the Local Authority under the Technical Instruction Act (or by its Committee) when it supervises classes under the Science and Art Department, or failing these by the Chairman of the School which has been longest in connexion with the Department, but the meeting will elect its own chairman. The nomination or recommendation must be sent in by the Chairman of the Special Committee not later than 24th February. If the Special Committee fail to come to an agreement, or if it nominate a person of whom the Department cannot approve, the Department will appoint the Special Local Secretary. The appointment of the Special Local Secretary and Assistants rests with the Department, and is for one year only.

No persons who have relatives to be examined within their district or who are ineligible to act as members of a Local Committee (see § IX., sec. *a*) can act as Special Local Secretaries or as Assistants.

In the deliberations and voting of the Special Committee weight should be given to the opinions of the representatives of different committees in proportion to the number of classes and the number of students superintended by each committee. The details for giving effect to this principle are left to the locality to decide.

Local contribution toward the expenses of examination.

XXV. One moiety of the fund for paying the Special Local Secretary and the Assistants on the scale given in §§ XXII. and XXIII. must be contributed by the locality. When a certificate on Form No. 983 has been received from the Special Committee, that one moiety has been lodged with them, they will receive the other moiety from the Department.

A Special Local Secretary is empowered to require each school or class, having students for examination, to pay its contribution to the general expenses prior to the time of the examination; and to exclude from the examination the students of any school or class from which such contribution has not been received.

XXVI. Committees are required to make arrangements for admitting outside candidates to any examinations they hold for their classes other than those in Practical Inorganic Chemistry; Practical Organic Chemistry; Practical Metallurgy; or Elementary Modelling; provided that the candidates apply to the Secretary of the Committee or to the Special Local Secretary, where one has been appointed, before the 15th March for admission to the examination. The Committee or Special Local Secretary may charge such outside candidates a fee not exceeding 2*s.* 6*d.* for each day or evening of examination for which they register their names (*see* sec. 7, p. 26). Examination of external Students.

This fee is not claimable on account of the students or Teachers of Science and Art schools and classes which are amalgamated for examination, or of those schools or students who are required either by the Department or by the local arrangements to go to any special centre for examination.

No outside student should be admitted to an examination unless he has made application, by the above-mentioned date, to the Secretary of the Committee holding the examination, or to the Special Local Secretary of the place where he proposes to be examined.

In the case of examinations held under a Special Local Secretary external candidates must apply to him and not to a Local Committee.

Individual candidates may be examined at South Kensington, as far as space will permit. A fee of 2*s.* 6*d.* per evening, or a composition fee of 10*s.* for any number of evenings (except for the examinations in Practical Chemistry and Practical Metallurgy), will be charged if application (on Form No. 325) is made before 15th March, and of 5*s.* for each evening afterwards, or, if made before 15th April, a composition fee of 20*s.* for any number of evenings. For Practical Chemistry and Practical Metallurgy the fee will be 5*s.* for each examination if application be made before 15th March, or 10*s.* for each examination if made later but before 15th April, and these subjects are not included in the composition fee previously specified. If there are more candidates than can be examined, the preference will be given to registered candidates for Exhibitions and Scholarships. Applications for examination at South Kensington cannot be received after 15th April.

Schools and Classes cannot be examined at South Kensington.

Application for Examination Papers.

XXVII. Application by Local Committees for examination papers must be made to the Department on Form No. 119 before the 21st March. *A list of the names of the Candidates to be presented and the Science and Art subjects to be taken by each Candidate must be forwarded on the fly leaf to Form No.* 119, *at the same time* Application for Examination by Local Committee.

as the application for papers. On the 21st March the Department's examination lists will be finally closed. Applications after the proper date, or such as have not been made STRICTLY in accordance with the rules will not be entertained.

Application by Special Local Secretary or by Amalgamated Committee.

In places where a Special Local Secretary has been appointed under § XXII., or an Amalgamated Examination Committee has been formed under § XXI., Form No. 119 should be sent, not later than the 16th March, to the Special Local Secretary or the Secretary of the Amalgamated Committee, as the case may be, who will transmit it to the Department.

Rules.

The rules for conducting the examinations will be found for Science on Form No. 91, p. 127, and for Art on Form No. 965*c*, p. 135.

Department not responsible for errors.

XXVIII. All possible care will be taken that the examination papers shall be forwarded in accordance with the applications, and that the results shall be correctly issued. As, however, the number of schools and classes is very large, mistakes may occur. The Department cannot undertake to rectify them, nor will it be responsible for any loss which may accrue.

Custody of Examination Papers.

Custodian of Examination questions.

XXIX. With a view to avoid any possibility of the examination papers being tampered with, some person must be appointed for each district, who will make himself responsible for the custody and distribution of the packets of papers after their receipt by the post, and who, from the position of his residence and the nature of his other avocations, is enabled to do so. He may or may not be a member of a committee, or the Special Local Secretary, but no person who would be ineligible to act as a member of a committee can act as a custodian of examination questions (*see* § IX., sec. *a.*).

The packets of examination questions must not under any circumstances be permitted to pass into the hands of a teacher, of a candidate for examination, or of any other person interested in the success of the examination.

Local circumstances will dictate whether it be advisable to have one, or more than one, custodian for each district or section of a district.

XXX. A special meeting of all the committees, or of delegates from all the committees, in the district must be held to nominate the custodian. This meeting will be convened in the same manner as that laid down for the meeting for the appointment of a Special Local Secretary,

see § XXIV. This nomination, with the address of the gentleman nominated, must be submitted to the Department before the 24th February. If the nomination is approved the packets of examination questions will, in due course, be sent to him; he will be responsible for their safe custody and distribution to the superintendents of the examinations at the various centres.

Re-examination.

Re-examination.

XXXI. Should there be at any time reason to suspect that an examination has not been properly conducted, or that particular candidates have not worked their papers fairly, the Department will investigate the case, and may require a further examination to be held in any manner it may deem advisable. If any candidate should fail to appear at such investigation, or decline to be re-examined, all his previous examinations may be cancelled.

PAYMENTS TO LOCAL COMMITTEES ON THE RESULTS OF EXAMINATIONS.

Conditions of payment.

XXXII. Payments are made to the committees of schools or classes on the results of the instruction of the students, as tested by examination, on condition—

(i.) that the teacher is qualified under the regulations (*see* Science, secs. 5 and 5*a*, pp. 24 and 25, and Art, secs. *8* and *9*, p. 63).

(ii.) that the teacher has given at least 28 lessons during the session, and before the examination in the subject of Science, or group of subjects of Art, on which payment is claimed (*see* § XV.).

(iii.) that each student on account of whom a claim is made belongs to one or other of the following categories :—

Students for whose instruction payments are made.

(*a.*) Persons in the receipt of weekly wages, and their children not gaining their own livelihood;

(*b.*) Teachers and pupil-teachers of elementary schools in connexion with the English or Scotch Education Departments, or the National Board of Education in Ireland, and their children if not gaining their own livelihood;

(*c.*) Persons in the receipt of not more than 400*l.* a year from all sources, *i.e.*, who are allowed an abatement of the income tax; and their children if not gaining their own livelihood:

(*d.*) Scholars in Public Elementary Schools within the meaning of the Elementary Education Acts; and Scholars who on leaving the Elementary School are proceeding with their education in Science or Art Schools or classes.

(*See* exception in Art, sec. 17 on p. 68 and sec. 3 on p. 86.)

(*e.*) Students in an organized Science School (*see* § 22, p. 33, *et seq.*) under public management, or in a night class for industrial students which meets after 6 p.m. or, on Saturdays, after 2 p.m.

If at any time there is reason to suppose that the organized Science School or the night class is not *bonâ fide* for Industrial Students, and largely attended by them, the Department may call on the Committee to certify that each individual on whom payment is claimed comes within one of the preceding categories.

(*See also* exceptions in Science, secs. 15 to 21, pp. 30 to 32, and in the special rules applying to Irish National Schools and Teachers, p. 56.)

(iv.) that each student on account of whom payment is claimed for any subject has received 20 lessons at least in (*a*) that subject of Science, or that group of stages in Mathematics, or (*b*) in the requisite group of subjects in Art—and that the attendances have been duly registered (*see* § XVII., sec. 6, p. 26, and Form No. 1069, p. 110).

Attendances supporting claim.

(v.) that all such attendances have been made since the last examination in the subject of Science or group of Art subjects at which the candidate was successful; within the two years immediately preceding the examination on account of which the claim is made; and in classes under the supervision of the same committee.

Claim for payments.

XXXIII. The details of the payments on results for Science are given at p. 30, and those for Art at p. 73. The claim for payments on results must be signed by the Secretary or Chairman and at least two members of the Committee at a meeting of the Committee held specially to examine and certify the same (*see* p. 132 for Science, and page 141 (Form No. 526) for Art.

All claims for payments should be made as soon as possible after the results of the examinations are issued and before the 31st *October*. This is necessary in order to enable the Estimates for presentation to Parliament to be prepared. The attendance register must be sent with the claim. *From all Schools of Art and Branches of Schools of Art; and from all Science Schools and Art Classes which have not been inspected during the session, the General Register must likewise accompany the claim.*

REWARDS TO STUDENTS.

Medals, Prizes and Certificates.

XXXIV. The conditions on which medals, prizes and certificates are awarded to students are given at p. 36 for Science, and at p. 74 for Art. All claims for Prizes must be made before the 31st December succeeding the examination.

LOCAL SCIENCE AND ART SCHOLARSHIPS AND EXHIBITIONS.

Scholarships and Exhibitions.

XXXV. Grants are made to aid local efforts in founding Scholarships and Exhibitions on the condition that they are awarded on the results of a competition, and that a sufficient sum is provided for the special purpose of the Scholarship or Exhibition by the voluntary contributions of living persons.

Funds derived from endowments or from moneys held in trust, the donor being dead; subscriptions not raised for this definite purpose; and other mere surplus funds, will not be held as satisfying this condition. The Department may refuse to aid any Scholarship or Exhibition for which there is not a sufficient number of competitors.

Local Science and Art Scholarships.

XXXVI. Science and Art Scholarships.—These Scholarships are for competition among the pupils of an Elementary School or Schools or of an organized Day Science School (*see* § 22, p. 33, *et seq.*). The object of the Scholarship is to enable the Committee of the local fund to maintain the successful competitor while pursuing his studies for one, two, or three years, at a day school approved by the Department where more advanced instruction is given than in an ordinary Elementary School.

The term elementary school includes any school, or department of a school, at which elementary education is the principal part of the education there given; but does not include any school or department of a school at which the ordinary payments in respect of the instruction, from each scholar, exceed ninepence a week, or which is conducted for private profit.

Contributions by locality and by Department.

XXXVII. The Managers of the local fund must contribute 5*l.* each year, and lodge that sum annually with the Department before 5th April. For the first year of tenure of the Scholarship, the local contribution will be supplemented by the Department with a grant of 4*l.*; for the second year with a grant of 7*l.*; and for the third year

with a grant of 10*l*. But it will rest with the locality to decide whether the Scholarship shall be tenable for one, two, or three years.

CONDITIONS—

Conditions.

a. With any number of students up to 100 on the register of the school or group of schools there can be but two such Scholarships; above 100 and up to 150, three; above 150 and up to 200, four Scholarships, and so on.

b. The Scholarship or Scholarships must be awarded in a *bonâ fide* competition to the most successful student or students in some examination of the school. The absolute terms of the competition and the award of the Scholarship will be left to the managers of the school, subject to the approval of the Department of Science and Art.

c. The scholar must, at the time of first appointment, be under 16 years of age on the 1st May in the year in which his appointment to a scholarship is made.

d. The teacher, pupil-teacher, or other paid servant of a school is not eligible.

e. The scholar must continue to attend a day school regularly while the school is open during a period of twelve months ending 31st July, and—

f. *In his first year and in each succeeding year during which he holds his Scholarship, he must be presented at the May examinations in one or more subjects of Science or of Art and show by the results he obtains that he has made satisfactory progress.*

Method of procedure.

Application for the Scholarship must be made on Form No. 280 before the 5th April. The examination on which it is awarded must be held, and the Form No. 281 submitting the name of the successful competitor must be sent in, before the 1st August. One moiety of the local contribution will be paid to the parent or guardian of the scholar by the Department on the 1st September, on the receipt of a certificate (Form No. 1066) from the managers that he is going on satisfactorily. The other moiety will be paid in the same way on the 1st February. The Department's grant becomes due after the results of the May examination in the subsequent year have been issued, and when the conditions of the Scholarship have been fulfilled. Application for its payment must be made on Form No. 282.

Continuance.

Should it be desired to continue the Scholarship for a second or third year, application must be made on Form No. 473. This form must be sent in as soon as the results of the scholar's examination, held at the close of his first or second year, are made known.

Local Science and Art Exhibition.

XXXVIII. LOCAL EXHIBITIONS.—A grant of 25*l*. per annum is made to the managers of the local fund who raise by voluntary contribution, and lodge with the Department before the 5th April, the like sum for the maintenance of a student at some college or school where a thorough course of science, or of art, instruction of an

advanced character may be obtained. His whole time must be devoted to instruction. The exhibition may last for one, two, or three years.

CONDITIONS— Conditions.

a. The Exhibition must be awarded in competition in Science or Art, at the May examinations of the Department. The managers may select the subjects of Science or branches of Art for the competition, and they may fix any relative amount of marks they consider best to assign to them.

b. The place or places where the Exhibition is to be tenable and where the student is to pursue his studies may be fixed by the managers, subject to the approval of the Department, provided that the Exhibitioner shall always have the option of going to the Royal College of Science—or the National Art Training School—South Kensington; the Royal College of Science—or the School of Art—Dublin, at which the fees for instruction will be remitted. If the Exhibition is held at the Institution applying for the Department's grant, the fees for instruction in it must be remitted to the Exhibitioner.

c. The Exhibitioner must be a student of the class on account of which payments on results are claimable, *see* § XXXII., sec. iii.

d. The grant of the Department will be paid from year to year on condition that a like payment has been made by the managers or Local Committee, and that the student has pursued his studies satisfactorily according to regulations fixed by the Department.

XXXIX. Application must be made for the Local Exhibition (Form No. 286) before the 5th April. It is awarded on the results of the May examinations, and the Department must be informed where the Exhibitioner will pursue his studies before the following 1st September. 10*l.* of the local contribution will be paid to the Exhibitioner by the Department immediately it is notified to it that he is commencing his studies. For the next three months of term, a further monthly payment of 5*l.* will be made out of the local contribution. 5*l.* per month for three more months will be paid from the Department's grant when a certificate (Form No. 851) has been furnished by the Principal of the Institution at which the Exhibition is held, stating that the Exhibitioner is going on satisfactorily. The payment of the balance (10*l.*) of the Department's grant will be made when the session terminates, and when a satisfactory report of the Exhibitioner's progress in his studies has been received from the Principal. Date of application.

If the Exhibition is held at the Royal College of Science—or the National Art Training School—South Kensington, 5*l.* will be paid to the exhibitioner monthly during the session by the Department.

Continuance.

Application for the renewal of the Exhibition for a second or third year must be made on Form No. 472 as soon as the payment of the Department grant towards the Exhibition for the preceding year has been made.

INSPECTIONS.

Inspection.

XL. When necessary an Inspector of the Department will visit the school or class, and report on the condition and suitability of the premises and fittings; the sufficiency of the apparatus, &c. used in the instruction of the school; the character of the instruction; the constitution of the Committee; and the manner in which the regulations are carried out. A meeting of the Committee must be held when the Inspector visits the school unless he considers it unnecessary.

GRANTS AND PRIVILEGES ALLOWED TO TEACHERS.

XLI. These are stated in detail at p. 39 for Science and at p. 79 for Art.

FREE ADMISSIONS TO MUSEUMS AND LIBRARIES.

Free Admissions.

XLII. Tickets of admission to the South Kensington —including the Science and Art Libraries—and to the Edinburgh Museum of Science and Art are given to Donors and lenders to the Museum, persons who are qualified to earn payments on results in Science or in Art, teachers of Public Elementary Schools, students of various public institutions, and handicraftsmen and persons engaged in trades which depend on decorative Art.

Application must be made by letter to the Secretary, Department of Science and Art, or to the Director of the Museum in Edinburgh.

STUDENTS must apply through the Secretary or Teacher of their School.

GRANTS TOWARDS THE PURCHASE OF OBJECTS, &c. TO MUSEUMS.

Grants to Museums.

XLIII. Grants in aid of the purchase of objects are made to Museums in connexion with Schools of Science or

Art, or established under a Municipal or a Local Authority.

The grants are primarily intended to assist local Museums in obtaining reproductions in plaster, or by the electrotype process, or by photography; but they are not absolutely limited to reproductions. Grants may be made for the purchase of original objects of decorative Art or of Science; but in considering the applications preference will always be given to those for reproductions.

The application for the grant must be accompanied by—

(*a.*) A list of objects which it is desired to purchase.

(*b.*) A copy of the rules under which the Museum is administered, including those for the admission of visitors and of students.

Preparation and transmission.

Before a grant can be sanctioned the objects must be approved by the Department. No grant is made towards the cost of carriage of the objects. No object on which aid has been granted may be sold or exchanged without the permission of the Department.

Limit of aid.

The grant will, in no case, exceed one half the cost of the objects purchased; and it must be met by at least an equal amount raised locally by rate or voluntary contribution, exclusive of any sum received under the Local Taxation (Customs and Excise) Act, 1890.

Mode of procedure.

The grant will be paid on the receipt of a certificate that the objects have been paid for and deposited in the Museum (Form No. 132*a*), supported by the original vouchers with the receipts of the vendors.

Inspection.

The Museum in which the objects are exhibited must be at all times open to the inspection of the officers of the Department.

Report.

A report on the Museum, containing a return of the number of persons who have visited it, must be forwarded annually to the Department as soon as possible after the 31st December.

Application for grant.

All applications for grants must be made before the 25th July, so that they may be considered together with a view to the allocation of the vote available for such grants in the financial year.

LOANS TO SCHOOLS AND MUSEUMS.

Loans.

XLIV. Objects of Science and of Art are lent for exhibition to Schools of Science or of Art, and to Museums established under a Municipal or a Local Authority.

Exceptional loans.

XLV. Objects are also lent exceptionally to localities where no School of Science or Art or Municipal Museum exists, on conditions determined by the circumstances of each case, provided that the proceeds of the Exhibition are devoted to the furtherance or establishment of a School of Science or Art, or of a Municipal Museum.

Contents of Museum and Libraries.

XLVI. The Museum and Libraries at South Kensington contain objects, books, drawings, photographs, &c., illustrative of the following subjects :—

Machine Construction.
Building Construction.
Naval Architecture.
Theoretical Mechanics.
Sound, Light and Heat.
Magnetism and Electricity.
Chemistry.
Animal Physiology.
Botany.
Navigation.
Steam.
Physiography.
Principles of Agriculture.

and the following branches of art :—

Sculpture in Marble, Stone, &c.
Mosaics.
Carvings in Ivory, Bone, &c.
Woodwork.
Metal Work.
Coins and Medals.
Arms and Armour.
Silversmith's Work.
Jewellery.
Enamels on Metal.
Pottery and Porcelain.
Glass Vessels.
Stained Glass.
Leather Work, including Book Binding.
Textile fabrics.
Lace.
Musical Instruments.
Decorative Paintings.

Loans for Temporary Exhibitions.

Loans for exhibition.

XLVII. The conditions under which objects are lent for a short period are as follows :—

a. That the objects lent by the Department are supplemental to other contributions.

b. That adequate provision, previously approved by the Department, is made for exhibiting them.

c. That their security and safe return is guaranteed.

d. That the exhibition is open to the public, both during the day-time and the evening.

e. That students of the School are admitted free; that arrangements are made for the admission of artizans who are not students in the School at a reduced rate on certain evenings; and that, in the event of the Exhibition remaining open more than three months, it be free at least on one day and one evening in each week.

f. That any surplus in the receipts is applied for the benefit of the School or Museum with which the exhibition is connected.

Applications for the loan of objects must be made on Form No. 605. But the Department, whilst consulting the wishes of the local authorities as to the nature of the objects, reserves to itself the absolute right of selection.

The arrangements for the carriage of the objects should be made by the Local Committee, but the Department reserves to itself the right of forwarding the collection

by any route. The Committee is required to pay *half* the charges for carriage to the Exhibition and back. When it is deemed advisable to send an attendant in charge of the collection the Committee is required to contribute 3*s*. 6*d*. a day towards his wages.

If any object be received in a damaged state a report of its condition should immediately be sent to the Department.

Glass cases, for the objects belonging to the Museum which require protection, will be provided by the Department, and every object will be accompanied by a descriptive label.

Loans for Permanent Museums.

XLVIII. Such loans remain at a Museum for twelve months; at the expiration of that period they are withdrawn, when a fresh contribution may be sent. Application for a loan should be made on Form No. 605*a*. Loans to Museums.

The conditions are the same as for loans for short periods, except that the Museum must consist of at least one room or gallery entirely devoted to the exhibition of objects, and must be open free at least on one day and one evening in each week.

Loans for Study in Schools of Science and Art.

XLIX. Apparatus, paintings, drawings, &c. are lent for the purpose of study to Schools of Science and Art. These loans are of two kinds, (*a*) the deposit loan, the objects being left for considerable periods, and (*b*) the temporary loan usually made for about twelve weeks in the case of Art objects, and for about three weeks in the case of Science apparatus. The Committee are required to enter into the same guarantee for the safe custody and return of the objects as when they are lent for exhibition. Application should be made for Science apparatus, on Form No. 802, before the 1st October, and for works of Art on Form No. 668. Loans for study.

The deposit loan is principally to provide objects for still-life painting or special subjects of study.

Schools of Art are entitled to borrow two folios, four quartos, or eight octavo volumes at one time from the Art Library. Application for the loan must be made on Form No. 273. The books are lent for two months and must be kept in the School.

Specimens of students' works for the advanced stages, both those executed at the personal examinations and those submitted for examination at South Kensington, will be lent to Schools for a period not exceeding two weeks. Application should be made on Form No. 159.

TECHNICAL INSTRUCTION.

N.B.—These grants are suspended, except in Ireland, while the Local Taxation (Customs and Excise) Act, 1890, continues in force.

Technical Instruction in Ireland.

L. Grants will be made in Ireland in aid of Technical Instruction given under the Technical Instruction Act, 1889 [52 & 53 Vict.].

LI. The grant in aid will be made to the school aided by the Local Authority and will be equal in amount to the sum contributed by the Local Authority out of the rates for instruction in subjects other than those for which the Department gives aid under the Science and Art Directory; provided that the subjects of instruction have been approved by the Department and that the Inspector of the Department reports that the instruction is properly given.

LII. The programme of instruction with the arrangement made by the Local Authority for its aid must be submitted to the Department, at the commencement of the school year, for sanction.

LIII. The payment of the grant allowed will be made at the end of the school year on the certificate of the officer of the Local Authority showing the amount contributed out of the rates and a detailed statement certified by the Committee or managers of the school of the expenditure of this money on subjects of instruction approved by the Department and not aided under the Science and Art Directory.

CHAPTER II.

REGULATIONS SPECIAL TO SCIENCE.

1. Aid is given towards instruction in the following Subjects of Science:— List of Science subjects.

Subject	I.	Practical Plane and Solid Geometry.
„	II.	Machine Construction and Drawing.
„	III.	Building Construction.
„	IV.	Naval Architecture.
„	V.	Mathematics.
„	VI.	Theoretical Mechanics.
		a. Solids.
		b. Fluids.
„	VII.	Applied Mechanics.
„	VIII.	Sound, Light, and Heat, Elementary Stage.
		a. Sound, Advanced Stage, and Honours.*
		b. Light „ „ „*
		c. Heat „ „ „*
„	IX.	Magnetism and Electricity.*
„	X.	Inorganic Chemistry [Theoretical].
„	X*p.*	Inorganic Chemistry [Practical].
„	XI.	Organic Chemistry [Theoretical].
„	XI*p.*	Organic Chemistry [Practical].
„	XII.	Geology.*
„	XIII.	Mineralogy.
„	XIV.	Human Physiology.*
„	XV.	General Biology. [N.B.—The numbers of
„	XVI.	Zoology.* XV., XVI., and XVII.
„	XVII.	Botany.* have been re-arranged.]
„	XVIII.	Principles of Mining.
„	XIX.	Metallurgy [Theoretical].
„	XIX*p.*	Metallurgy [Practical].
„	XX.	Navigation.
„	XXI.	Nautical Astronomy.*
„	XXII.	Steam.
„	XXIII.	Physiography.
„	XXIV.	Principles of Agriculture.*
„	XXV.	Hygiene.

The subjects are subdivided into stages or courses—the Elementary, the Advanced, and Honours—with the exceptions shown in the syllabus, pp. 145 to 262.

In the subjects marked with an asterisk there may be a practical as well as a written examination in Honours (*see sec.* 10).

PREMISES, FITTINGS, AND APPARATUS.

A.—Building Grants (*see* § XIII.).

Building Grants.

2. The conditions of and the mode of application for, a grant to build or adapt a Science School will be found at p. 113.

N.B.—Grants for Fittings and Apparatus are suspended, except in Ireland, while the Local Taxation (Customs and Excise) Act, 1890, continues in force. The conditions under which they are made in Ireland are contained in Form No. 48, which can be obtained on application.

Instruction in Experimental Science.

3. Instruction in experimental Science must not be given without sufficient apparatus to illustrate the teaching. A list of the apparatus, &c., considered indispensable for teaching Subjects I., II., VI., VII., Elementary Physics, VIII., IX., X., XII., XIV., XVII., XXII., XXIII., XXIV., XXV., is given at page 121; for Science subject X*p.*, at page 198; for Science subject XI*p.*, at page 205; and for Science subject XIX*p.*, at page 242. The apparatus prescribed in each case is the minimum with which a class must be provided. No payments will be made, or examinations held in the Elementary stage in schools which are not furnished with that amount of apparatus; or—where advanced instruction is given—without sufficient apparatus to make the experiments referred to in the syllabus of each subject. The teacher may be called upon by the Inspector to show his ability to use this apparatus.

Catalogues of apparatus.

4. Catalogue of apparatus, instruments, diagrams, &c. to illustrate the following sciences, will be sent on application:—

(Cat. No. 1.) Practical Geometry, Machine and Building Construction, Mechanics and Steam.
(Cat. No. 2.) Experimental Physics.
(Cat. No. 3.) Chemistry and Metallurgy.
(Cat. No. 4.) Geology and Mineralogy, Natural History (Physiology, Zoology, and Botany), Physiography and Agriculture.

Qualification of Science Teachers.

Qualification for earning payments on results.

5. In order to obtain payments on the results of instruction in a subject of Science, the teacher of the class must, before giving the instruction on which a claim is to be made, have obtained in that subject—

a. a First Class in the Advanced Stage at the May examinations; or

b. a class in "Honours;" or,

c. a certificate of the Royal College of Science, London, or of the Royal College of Science, Dublin; or,

d. a first class certificate in the advanced stage, or a class in Honours at the special examination in Training Colleges, see p. 50.

A pass in Section I. (Geometrical Drawing) of the Elementary Stage of Practical Plane and Solid Geometry, or any higher success, qualifies the holder to earn the grant under section 14*e*. See page 30.

Holders of the Elementary Drawing Certificate (1st Class), or the Elementary School Teachers Certificate D.; or the Second

Grade Drawing Certificate, are qualified to earn payments on results of their instruction in the Elementary Stage of Practical Plane and Solid Geometry.

Mathematics. In Mathematics, a First Class at the May examination in each stage qualifies the holder to earn payments on results in that stage, or in the preceding stages: and Honours in stages 3, 5, and 7, qualify in those and the preceding stages. A pass in stage 1 of the Training College examination qualifies in stage 1, 2, 3, 4. A pass in stage 2 of the same examination qualifies in all the stages.

In Theoretical Mechanics a first class in the advanced stage of subdivision (*a*) or (*b*) qualifies the holder to earn payments in that subdivision, and also in the elementary stage (*a*) and (*b*). Honours in (*a*) or (*b*) qualify the holder to earn payments in VI. (*a*) and (*b*).

In Sound, Light, and Heat a first class in subdivision (*a*) or (*b*) or (*c*) qualifies the holder to earn payments in that subdivision, and also in the common elementary stage.

Honours in subdivision (*a*) or (*b*) or (*c*) qualify the holder to earn payments in VIII. (*a*), (*b*), and (*c*).

Alternative course in Physics. The qualification to earn payments on results in either Subject VIII. or Subject IX. also qualifies in the alternative course in Physics.

Practical Chemistry and Metallurgy. In Practical Chemistry (Inorganic or Organic) or in Practical Metallurgy the Teacher must have obtained a First Class in the advanced stage or a success in Honours of both the theoretical and practical divisions of those subjects. This rule does not apply to Teachers who had been accepted by the Department and who had taught classes in Practical Chemistry or Practical Metallurgy before May 1883.

All persons who were qualified to earn payments on results in any subject of Science previous to July 1888, and who at that date were teaching, or had previously been teaching, a class in that subject under the Department of Science and Art, remain qualified to earn payments in that subject.

Certificates prior to 1867. The Science Teachers' Certificates awarded previously to 1867 still remain in force, and with regard to them and the alterations made in Subjects XV., XVI. in 1873, and in Subject XXIII. in 1876, information can be obtained on application to the Department.

Qualification without examination. 5*a*. The examination for qualification to earn payments on the results of Science instruction may be dispensed with in the case of—

(*a*.) the teachers of a school under the Public Libraries Acts; of a school (not being a public elementary school within the meaning of the Elementary Education Act, 1870) governed by a scheme under the Endowed Schools Acts or the City of London Parochial Charities Act, the Governors of which act, in their corporate capacity, as Local Committee, (see § IX., section 1); of a school which is under the control of a local authority under the Technical Instruction Act; or of certain other recognised public institutions.

Training College Teachers. (*b*.) teachers on the staff of Training Colleges who are regularly employed in them;

(*c*.) Associates of the Royal College of Science, London, or of the Royal College of Science, Dublin;

(*d.*) graduates of any university of the United Kingdom whose degrees cover the subjects they propose to teach;

Elementary School Teachers.

(*e.*) teachers certificated by the English or Scotch Education Department in respect of Mathematics (Subject V.) Stage 1;

(*f.*) teachers holding the Art Master's Certificate, Group I., dated previously to March 1893, in respect of Science Subject I.;

(*g.*) and, exceptionally, other specially qualified persons.

Formal application by Committee necessary.

All applications for exemption under these sections must be made by the Committee of the School under which the teacher is to act. The application must be made before he commences to teach, and must, in the case of a University Graduate, be accompanied by his diploma or a certificate from the registrar of his University.

Irish Schools.

Special rules for Irish Schools and Classes will be found at p. 56.

Registration of Students.

Limitation.

6. A student may not be registered for lessons in more than two subjects on any one day, or for more than one lesson in any one subject—except on a Saturday, when lessons in three subjects may be registered. Each lesson must be of at least one hour's duration.

Under certain circumstances, on special application and where sufficient reason is shown the Department may sanction in day schools the registration of attendance at instruction in Science subjects, though such instruction is of but 45 minutes' duration. Where such sanction is accorded 40 lessons at least must be given in each subject by the teacher during the session; each student on account of whose success a claim is made must have been registered as present at not less than 30 such lessons; and all the Science instruction of the school (except in Subjects X*p.*, XI*p.*, and XIX*p.*), must be given in 45 minutes' lessons.

When lessons of 45 minutes' duration are exceptionally sanctioned, such lessons may be registered in three subjects on one day.

The lessons in Subject X*p.* Practical Inorganic Chemistry, XI*p.* Practical Organic Chemistry, and XIX*p.* Practical Metallurgy, must be each of at least one hour and a half's duration.

Time Table.

The time table, Form No. 120, should provide for a sufficient interval between the end of one lesson and the beginning of the next, to allow a change of students, and any necessary apparatus to be set up.

EXAMINATIONS.

Examination how held.

7. The examinations in the three stages of a subject—or in Mathematics, in a group of stages—are as a rule held at the same time, a separate series of questions being given in each stage. The Elementary and Advanced stages are for the general students in Science Classes. The "Honours" examination is of a very advanced character. In the elementary stage the candidates are recorded "*passed*," "*fair*," or "*failed*." In the advanced stage and in Honours there are two grades of success—first and second class. For a "pass" in the elementary stage, the standard of attainment required is about 60 per cent. of the marks obtainable, *while a student who obtains more than about 40 per cent. of the marks obtainable will be recorded as "fair";* but the standard may be raised from year to year.

The Department may require from a Local Committee a payment of 1*s.* *for every paper of answers in Section I.* (*Geometrical Drawing*) *of Science Subject I.* and of 2*s.* 6*d.* for every paper of answers in any other subject of Science which the examiner reports as obtaining less than 25 per cent. of the marks. A Local Committee may, therefore, call upon any candidate who against their wish insists upon entering for examination in any subject to deposit 2*s.* 6*d.*, to be returned if the Department does not require such payment from the Committee External candidates may be required by the Local Committee or Special Local Secretary to make a similar deposit of 2*s.* 6*d.* for each subject of examination, in addition to the usual examination fee.

8. The examinations in the subjects and stages bracketed together in the following time-table will be held on the same evening. No candidate can be examined in more than one of these bracketed subjects in any one year, or in two stages of any subject except Mathematics, in which subject he may take one stage in each group. Classification of results of examinations.

TIME TABLE OF SCIENCE EXAMINATIONS IN ENGLAND, SCOTLAND, AND WALES.

In the year 1895 the examinations will be held as follows:—

1895.		p.m.	
27 April,	Saturday	6 to 10	I.—Practical Plane & Solid Geometry.
4 May	Saturday	6 to 10	II.—Machine Construction and Drawing.
		„	III.—Building Construction.
		„	IV.—Naval Architecture.
6 „	Monday	7 „ 10	XXIII.—Physiography.
7 „	Tuesday	„	XVIII.—Principles of Mining.
			V.—Mathematics, Stages 6 and 7.
			XXIV.—Principles of Agriculture.
8 „	Wednesday	7 to 10.30.	V.—Mathematics, Stages 1, 2, 3.
9 „	Thursday	7 „ 10	IX.—Magnetism and Electricity, including Alternative Elementary Physics.*
10 „	Friday	„	VIII.—Sound, Light, and Heat, Elementary Stage.†
			VIIIA.—Sound, Advanced Stage and Honours.

* A paper will be set in Elementary Physics at the examination on the 9th May 1895, and a candidate may on that date take either it or the paper in the ordinary elementary syllabus of Subject IX.; but no candidate may be examined in the syllabus of the ordinary elementary stage of Subject IX., or of Subject VIII. on the 10th May, and also in this alternative syllabus.

† Candidates in the first stage must take it as a whole, and will be expected to answer questions in Sound, and in Light, and in Heat.

In the second stage, and in the examination for Honours, the subject will be taken in three sub-divisions, and a candidate will be allowed to take up one or more of the sub-divisions, viz., Sound, Light, or Heat, in the same or in different years. But no candidate may offer himself for the Honours examination in any sub-division unless he has passed the second or advanced stage in that sub-division.

1895.		p.m.	
11 May,	Saturday	2.30 to 10.30.	XI*p*. Practical Organic Chemistry. — Elementary Stage, 6 to 9.30 p.m. Advanced Stage, 6 to 10.30 p.m. Honours, 2.30 to 10.30 p.m.
13 „	Monday	7 „ 10	VIA.—Theoretical Mechanics. Solids.
14 „	Tuesday	„	X.—Inorganic Chemistry, including alternative Elementary Chemistry.*
15 „	Wednesday	„	VIB.—Theoretical Mechanics. Fluids.
16 „	Thursday	„	XIV.—Human Physiology.
17 „	Friday	„	XI.—Organic Chemistry. / XXII.—Steam.
18 „	Saturday	2.30 to 10.30	X*p*. Practical Inorganic Chemistry. — Advanced Stage, 6 to 10.30 p.m. Honours, 2.30 to 10.30 p.m.
20 „	Monday	7 to 10	V.—Mathematics, Stages 4 and 5. / XXV.—Hygiene.†
21 „	Tuesday	„	XX.—Navigation. / XII.—Geology.
22 „	Wednesday	„	VIIIB.—Light, Advanced Stage and Honours.
23 „	Thursday	„	XV.—General Biology. / XIX.—Metallurgy.
24 „	Friday	„	VIIIC.—Heat, Advanced Stage and Honours.
25 „	Saturday	6 to 9.30	X*p*.—Practical Inorganic Chemistry, Elementary Stage.
27 „	Monday	7 to 10	XIX*p*.—Practical Metallurgy, Elementary Stage.
28 „	Tuesday	2 to 10	XIX*p*. Practical Metallurgy. — Advanced Stage, 6 to 10 p.m. Honours, 2 to 10 p.m.
29 „	Wednesday	7 „ 10	VII.—Applied Mechanics. / XVI.—Zoology.
30 „	Thursday	„	XVII.—Botany.
31 „	Friday	„	XIII.—Mineralogy. / XXI.—Nautical Astronomy.

This time-table is modified in Irish Schools, *see* section 4, p. 56.

Examinations in Practical Chemistry and Metallurgy.

9. Examinations in Practical Chemistry (Subjects X*p*. and XI*p*.) and in Practical Metallurgy (Subject XIX*p*.) are only held in schools provided with a laboratory which has been accepted as fulfilling the requirements detailed at pages 200, 206, and 244.

Where the number of candidates for examination exceeds the number of benches fitted up in the laboratory, they may be examined in divisions. Not more than two such divisions will be allowed, and the number of candidates in each division must not exceed

* A paper will be set in the First Stage of Inorganic Chemistry, and also in the alternative First Stage, and a candidate may take either paper but not both.

† No candidate can obtain Honours in Subject XXV. unless he has previously passed in its Advanced Stage, and in the Advanced Stage of Subject XIV.

the number of benches. This arrangement can, however, only be allowed where there are separate classes working at different times, and where the Inspector reports that it is justifiable. Thus, if the laboratory is fitted up with, say, 12 benches, and there are no candidates in Honours, 24 candidates may be examined in the Advanced Stage and in the Elementary Stage in divisions of 12 each.

A double examination in Practical Metallurgy will be allowed where four muffle furnaces as well as the other necessary furnaces have been provided for the laboratory. Thus the minimum number of students for which a double examination can be claimed will be 13.

Practical Examinations.

Local Practical Examinations.

10. Practical examinations for candidates in Honours in Subjects II., III., IV., VIII., IX., XII., XIV., XVI., XVII., XXI., and XXIV., may be held at South Kensington in addition to a written examination (*see* syllabus of each subject). Such practical examinations will be held as early as possible in the month of June. Candidates who are instructed to attend these examinations receive a maintenance allowance of 7*s.* 6*d.* a night while required to be absent from home and third class railway fare; but no cab or omnibus fares are allowed.

Pupils of Elementary Schools.

Pupils of an Elementary School.

11. No pupil in an Elementary School receiving aid from the English or Scotch Education Departments may be presented for examination by the Department of Science and Art, or registered in any subject of Science, unless he has *before* 1*st November preceding the examination* been placed altogether in Standard VII. of the English Code or has passed Standard VI. of the Scotch Code.

No one may be presented for examination by the Department of Science and Art in any subject in which he has been examined, since the preceding 1st August, by the English or Scotch Education Departments for a Class or specific subject grant. With regard to pupils of Irish National Schools, *see* Form No. 1234, p. 56.

Special Examination of Navigation Schools.

Special examinations in navigation.

12. In addition to the ordinary science examinations in May, examinations may be held in Mathematics, Navigation, Nautical Astronomy, and Steam, for the benefit of seafaring men—and for them only—twice a year in all seaports where Local Committees are formed and are willing to undertake them. These examinations take place in the beginning of February, and November. The application for these examinations must be made on Form No. 119 before the 10th day of the previous month. They are only allowed when there are at least 15 candidates for examination in the United Kingdom.

The payments on the results of these examinations are on the scale laid down for the May examinations (sec. 14), and the regulations with regard to Committees (§ IX.), registers (§ XVII.), and number of lessons (§§ XV. and XXXII.), are the same.

Conduct of Examinations.

Rules for examinations.

13. The detailed regulations for the conduct of the examinations, together with the instructions to candidates and the form of certificate to be signed by the superintendents, are given in Form No. 91 (*see* p. 127). For Irish schools in Form No. 91*b*. For Practical Chemistry, Analysis, in Form No. 91*d*., and for the written examination in the Advanced and Elementary Stages in Form No. 91*e*. For Practical Metallurgy in Form No. 91*m*. The requisite forms are issued, in due course, to Local Committees and Special Local Secretaries who have furnished returns on Form No. 119 (*see* § XXVII.).

PAYMENTS ON RESULTS.

Payments claimable on the results of the Class Examinations.

14. The payments claimable, subject to the conditions of § XXXII., on account of each student are:—

(*a*.) 2*l*. for a pass in the elementary stage of each subject;

(*b*.) 5*l*. and 2*l*. 10*s*. for a first or second class respectively in the advanced stage of each subject; and

(*c*.) 8*l*. and 4*l*. for a first or second class respectively in Honours:—

(*d*.) except that in Practical Inorganic and in Practical Organic Chemistry and in Practical Metallurgy, the payments are 3*l*. for a pass in the elementary stage, and 6*l*. and 3*l*. 10*s*. for a first or second class respectively in the advanced stage; and in Mathematics, 2*l*. for a pass in stage 1, 3*l*. and 2*l*. respectively for a first or second class in stages 2 and 4, 4*l*. and 3*l*. for a first or second class respectively in stage 3, 5*l* and 4*l*. for a first or second class respectively in stages 5, 6, and 7, and 8*l*. and 4*l*. respectively for a first or second class in Honours; and

(*e*.) for passing in section I. (Geometrical Drawing) of the elementary stage of Practical Plane and Solid Geometry, 10*s*.

Payments are made on each subdivision of Subject VI., Theoretical Mechanics, as a separate subject. In Subject VIII., Sound, Light, and Heat, the three subdivisions in the Advanced and Honours Stages are paid on separately.

A specimen of the manner in which the claim for payment (Form No. 51, or for Irish Schools, Form No. 51A) should be filled up is given at p. 134. Many details with regard to payments will be understood from the illustrations given in this form.

Previous success.

15. No payment is made on account of a student who has been previously successful in a higher stage of the same subject. If the student has been previously successful in the same stage of the same subject, either at a Training College Examination or at the May Examinations, the payment on his account will be reduced by the payment which would be claimable on such previous success; but when such previous success has been obtained in a school or class under the same Local Committee, and has not been paid upon, the Department may allow the full claim.

For instance, the payment of 5*l*. for a first class in the advanced stage would, if the student had previously taken a second class in that stage of the same subject, be reduced by 2*l*. 10*s*.

No deduction is made in the payment for the first stage of Subject I. on account of a previous payment for section 1 of that subject.

A charge of 2*s.* 6*d.* will be made for each paper of answers which the examiners report as obtaining less than 25 per cent. of the marks.

Honours.

16. No payments are made in Honours, unless the student has already passed in the elementary or in the advanced stage of the subject after instruction in a Science School in connexion with the Department.

Numbers of subjects paid upon.

Students on account of whom no payments are made for passing in the elementary stage under sec. 21 are not required to comply with this rule.

Payments will not be made on account of the same student in any one year in more than two subjects other than Subject I. (Practical Plane and Solid Geometry), and Subject V. (Mathematics). That is to say, either or both Subjects I. and V. may be taken in addition to any two other subjects. Subject V. (all the stages of Mathematics); Subject VI., divisions *a* and *b*; Subject VIII., divisions *a*, *b*, and *c*. Subject X. with X.*p* (Theoretical and Practical Inorganic Chemistry); Subject XI. with XI.*p* (Theoretical and Practical Organic Chemistry); and Subject XIX. with XIX.*p* (Theoretical and Practical Metallurgy); are each considered as one subject in the interpretation of this rule.

In an Organised Science School a student may take three subjects besides I. and V., and payments may be claimed on successes obtained in such subjects.

Grants only for appropriate subjects.

Grants are not made for instruction in subjects of Applied Science which are inappropriate to the students in the locality, A certificate will in all cases be required from the Committee of the class in which Subject XVIII., XX., XXI., or XXIV. is taught, that the students are, or are going to be, employed in a trade or industry to which the subject applies, or are going to be teachers of the subject.

17. Except under special circumstances, no payments are made on account of instruction in Stages 1, 2, and 3 of Mathematics to the Committee of a school in which approved instruction is not also given and examination held by the Department, in at least one other subject of Science other than Section I. of the Elementary Stage of Science Subject I. (Geometrical Drawing).

Practical Chemistry and Metallurgy.

18. To obtain payments for Practical Inorganic, or for Practical Organic, Chemistry, or Practical Metallurgy, the school must be provided with a laboratory fitted according to the Syllabus, pp. 200, 206, and 244. A certificate to this effect must be given by the committee on Form No. 120 (§ XVI.).

Extra grants in Subjects I., II., III., and IV.

19. Payments not exceeding 3*l.* for each student are made under the Art Rules, sec. *31d*, for works executed by students in Science Schools in Subjects I., II., III., and IV., and submitted in accordance with secs. 28, 29, and 30, p. 69; provided that the teacher is qualified to earn payments on results in the subject in which the works are submitted. Prizes are awarded for Works in these subjects.

Payments on Pupils of Endowed Schools.

20. The grant of payments on results in an endowed school, the endowment of which, applicable to the general maintenance of the School, exceeds 300*l.* a year, or in which the education is wholly or principally provided for by endowments, must be the subject of special reference to the Department; each case being considered on its merits.

Instruction in Institutions receiving State aid.

21. No grants are made in those branches of Science which are taught in Institutions receiving State Aid,—such as the Queen's Colleges in Ireland, the Royal College of Science, London, the Royal College of Science, Dublin, and the Royal Dockyard Schools—on account of the pupils who are, or have been, students of those institutions.

In the case of University Colleges in Great Britain which receive grants from the State under the Treasury Minute of 1st July 1889, payments are only made on account of the students of special evening classes for artizans, held in the colleges; and a certificate is required from the college authorities that no student on account of whom a claim is made is, or has been, a student of the day classes of the college in the subject or subjects in respect of which the claim is made.

The payment of 10*s.* for success in Section I. (Geometrical Drawing) of the Elementary Stage of Practical Plane and Solid Geometry is not made on account of a student who has been previously successful in 2nd Grade Geometry, or in Science Subject I. The rule in section 15, p. 30, with regard to the reduction of grants for previous successes, applies to the payments for Science Subject I.; but no reductions are made in them on account of payments for Practical Geometry (2nd Grade, Art), or for Geometrical Drawing.

A success in the alternative elementary stage of Physics is registered in the elementary stages of both Subjects VIII. and IX., and a success in the alternative elementary stage of Chemistry in the elementary stage of Subject X., and are so treated in making payments on results.

See also section 11 and page 23.

The restrictions in Dockyard Schools (*i.e.*, Engineers, Engineer Students, and Dockyard Apprentices), are as follows:—No payments or prizes for Engineer students and Dockyard apprentices, major trades.

a. Lower Division on account of success in Subjects V. (Stages 1, 2, and 3), VI. (Elementary Stage).

b. Upper Division in Subjects I. (Elementary stage), V. (All stages), VI. (All stages), VIII. (Elementary stage), IX. (Elementary stage), X. Theory (Elementary stage).

c. Dockyard Apprentices (major trades) of the Upper Division in Subject IV. (Elementary and Advanced stages).

d. Engineer Students of the Upper Division in Subjects VII. (All stages), XXII. (All stages).

No payments are made for Subject V., Stage 1, on account of Male Pupil Teachers and Male Assistant Teachers in Elementary Schools under the English or Scotch Education Department, or on account of Male Teachers trained at the public expense.

No payments are made for Subjects X*p.*, XI*p.*, or XIX*p.*, unless the laboratory in which they are taught has been approved as satisfying the conditions laid down.

ORGANISED SCIENCE SCHOOLS.

N.B.—The course of instruction in these Schools is now under consideration, and a circular with regard to it will be issued in due course.

22. An organised Science School is one in which the instruction in Science is carried on methodically according to the course specified in sec. 23, *but in preparing the time-table provision should be made for instruction in those literary subjects which are essential for a good general education.* Organised Science Schools.

It will depend on circumstances, especially if the student can only attend the Night School, how many subjects he can take up in one year. It is not necessary that any student should take in any one year all the subjects mentioned for that year. But his course must, if the special grants under sec. 26 are to be claimed, comprise the subjects named below, and they must be taken in the order in which they are stated.

It is assumed that before commencing this course the student will have been made acquainted, in the Elementary School, with the elements of Arithmetic and the primary conceptions of Physical Science.

23. The Course of Instruction in Science *in an Organised Science School, whether a Day School or a Night School, must be confined to students who are taking the full course.* This course, to which Manual Instruction (*see* Art Rules, p. 97) may be added, is as follows:— Course of instruction.

First Year.

Mathematics (Subject V. First Stage).

Elementary stages of subjects included under Art Group A. (*see page* 66), *i.e., Freehand Drawing in Outline of Ornament, Model Drawing, and Drawing in Light and Shade; and in Art Group B., Perspective only.*

Practical Geometry (Subject I.).

Chemistry, Inorganic (Subject X. First Stage) (*see* Syllabus, p. 186), with practical work.

Physics: Sound, Light and Heat (Subject VIII. First Stage); or Magnetism and Electricity, frictional and voltaic (Subject IX. First Stage); or Physiography (Subject XXIII. First Stage).

Second Year.

The Elementary Stage of Mechanics VI*a.* or *b.*

Physics: Sound, Light and Heat (Subject VIII. First Stage); or Magnetism and Electricity, frictional and voltaic (Subject IX. First Stage); or Physiography (Subject XXIII. Second Stage).

Mathematics (Second Stage and (if possible) Fourth Stage, Subject V.).

Practical Geometry (Plane and Solid), (Subject I.).

Chemistry, Inorganic (Subject X. Second Stage), with practical work.

Human Physiology (if possible), (Subject XIV. First Stage).

The instruction in the subjects of the second year must be kept distinct from that in those of the first year, but a second year's student may be examined in a subject of the first year in which he has *not previously passed*. The student should also, if possible, during the first and second year work at Mechanical Drawing as provided for in sec. 24.

Any slight modifications of the foregoing course of instruction which it may be desired to make should form the subject of special application, when they will be considered on their merits.

Third Year.

24. The work of this year must depend so much on the student's aptitude, and the progress he has made in the preceding course, that it is impossible to lay down the subjects for the third year's course with any definiteness. It is essential that before continuing his course, or commencing new subjects, he should have a sound knowledge of the first stage of Mathematics, the Elementary Stage of Mechanics VI*a*. or *b*, Physics, and Chemistry; that he should have such a knowledge of Practical Geometry and Mechanical Drawing as to be able to draw and read simple plans, elevations, and sections with readiness, and that he should have sufficient facility in Freehand Drawing to make clear and neat explanatory diagrams.

25. When these subjects have been mastered, the student should, while continuing his studies in Mathematics, take up the first stage of Human Physiology, if he has not already done so. He will then be in a position to specialize his studies with advantage in one of the following groups, according to his requirements, taking up, for instance—

1. Physics and Chemistry and Metallurgy.
2. Theoretical and Applied Mechanics, Steam and Machine Construction and Drawing.
3. Theoretical and Applied Mechanics, and Building Construction, and Drawing.
4. Biology.
5. Physiography, Geology, Mineralogy, and Mining.

The student may also with advantage continue his Freehand Drawing and Practical Geometry.

Note.—The foregoing course is framed to lay the foundation of a thorough and systematic scientific training. This will explain the omission of certain subjects which are not to be considered unimportant because they find no place in the course. Thus Systematic Botany will be found of very great use as a preliminary to the study of Natural Science. As such it may be taught in Elementary Schools before this course is commenced. But further than that, it cannot be considered a step in a systematic course till the student takes it up as a portion of Biology in his third year.

Extra payments in organised Science Schools.

26. A Day School organised to give the foregoing courses of instruction receives, in addition to payments on results, 1*l*. on account of each student who attends the full course of instruc-

tion; is present during 250 attendances of the school; and passes in one of the subjects of Science laid down for his year in which he has not previously passed, or obtains a higher success in a subject in which he has already been successful.

Conditions. Provided that—(1) an application be made on Form No. 122 before the 1st August in each year submitting a time-table of the school framed in accordance with the foregoing rules; that it be approved by the Department; and that a copy of such approved time-table be conspicuously exhibited in the class-room—(2) a special register (Form No. 486*d*) be kept, in which not more than two attendances are counted in one day—and (3) at least *13* hours of instruction per week allotted to subjects (*not including Manual Instruction*) taken under the Science and Art Department.

The school year of the Organised Science School is held to terminate on the 31st July.

In night Classes. 27. A Night School in the same way receives 10*s.* on account of each student who attends the full course of instruction, is present during 60 attendances of the school, and passes in one of the subjects of study laid down for his year.

Conditions. Provided that—(1) an application be made *on Form No.* 122 before the 1st August in each year submitting a time-table of the school. framed in accordance with the foregoing rules, and that it be approved by the Department—(2) the School be open *for not less than two hours on each of* 80 evenings at least in the year—and (3) a special register (Form No. 486*d*) be kept, in which not more than one attendance is counted for each student on each evening for the attendance grant, *each attendance being of at least two hours duration.*

The school year is held to terminate on the 31st July.

Restrictions. 28. A school claiming this special grant must be organised so as to give the full course specified. It will not be sufficient to provide for the subjects of the first year only. The attendance grant cannot be claimed on account of scholars on the register of a school under the English or Scotch Education Departments, or the Commissioners of National Education, Ireland.

Payments on the results of examinations in the Subjects of Art Group A. and in Perspective, in an organised Science School, under the approved teacher, are the same as those for Art Schools and Classes at the May examinations; but the general attendances of students (if they amount to 250 *in the case of Day Organised Science Schools, and if they amount to* 80 *in the case of Night Organised Science Schools), suffice to support claims for such payments. The payments are subject to the usual deductions on account of previous success. In respect of any other Art Subjects than those in Group A. and Perspective, attendances must be registered in the ordinary*

register—Form No. 486B, *and the teacher of the Organised Science School must be qualified according to the Art rules for such other subjects before payments on results according to the May rates are allowed.*

REWARDS TO STUDENTS.

Cards. Prize certificates.

29. A candidate who passes in any one of the stages of a Science subject receives a card or certificate recording his success in the examination unless he has previously obtained the same or a higher class in that subject.

Candidates in Honours in Chemistry or Metallurgy must pass in both the theoretical and practical examination, but not necessarily in the same year, before receiving a Certificate.

Queen's Prizes.

30. A small number of Queen's prizes of books, instruments, &c. are given to those who do best in the Advanced Stage of each subject, or in the second or any higher stage of mathematics,* provided that they are registered students in a school under the Department, and have received from a qualified teacher at least 20 lessons within the two preceding years in the subject in which a prize is claimed.

No student can receive a Queen's prize, except in Mathematics, unless he has previously passed in the elementary stage of the same subject.

Bronze Medals.

31. Bronze Medals are given to all candidates who obtain a first class in Honours.

Candidates in Honours in Chemistry or Metallurgy must obtain a first class in both the theoretical and practical examination, but not necessarily in the same year, before receiving a certificate or medal.

Candidates not eligible for prizes.

32. The following are not eligible for prizes :—

a. Students who have previously received one of these Queen's prizes for the same, or a higher class, in the same subject;

b. Teachers earning, or who have earned, payments under the Department;

c. Persons who are, or have been, students of the Queen's Colleges in Ireland, the Royal College of Science in London, the Royal College of Science in Dublin, the Royal Dockyard Schools, or of any other institutions receiving State aid in those subjects which are taught as a portion of the regular course in those Institutions.

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* Local Committees must make their own arrangements for obtaining the prizes. The Special Certificate on Form No. 161 should be completed and forwarded. The Department will then pay to the Local Committee the sum of 2*l.* for each prize gained, and furnish one prize label for each prize-winner; and the Committee must undertake to procure books or instruments for their students to the value of at least 2*l.* for each prize.

33. ROYAL EXHIBITIONS, NATIONAL SCHOLARSHIPS, and FREE STUDENTSHIPS.—The following are awarded in competition at the annual May Science examinations of the Department :— Royal Exhibitions, National Scholarships, and Free Studentships.

Twelve Royal Exhibitions—four open each year—to the Royal College of Science, London. Royal Exhibitions.

Nine Royal Exhibitions—three open each year—to the Royal College of Science, Dublin.

Sixty-six National Scholarships—twenty-two open each year—tenable at the option of the holder at either the Royal College of Science, London, or the Royal College of Science, Dublin. National Scholarships.

Eighteen Free Studentships—six open each year—to the Royal College of Science, London. Free Studentships.

No candidate can obtain more than one of these three classes of scholarship : viz., Royal Exhibitions, National Scholarships, Free Studentships.

A ROYAL EXHIBITION entitles the holder to free admission to lectures and laboratories and to instruction during the course for the Associateship—about three years—in the Royal College of Science, London, or the Royal College of Science, Dublin, with a maintenance allowance of 50*l.* a year. Value of Royal Exhibitions.

A NATIONAL SCHOLARSHIP entitles the holder to free admission to lectures and laboratories and to instruction during the course for the Associateship, about three years, at either the Royal College of Science, London, or the Royal College of Science, Dublin, at the option of the holder, with a maintenance allowance of 30*s.* a week for the session of about forty weeks each year, and Third class railway fare for one journey to and fro, each session, between the home of the scholar and London or Dublin, as the case may be. Value of National Scholarships.

A FREE STUDENTSHIP entitles the holder to free admission to the lectures and laboratories and to instruction during the course for the Associateship, about three years, in the Royal College of Science, London, but not to any maintenance or travelling allowance. Value of Free Studentships.

The Royal Exhibitions and Free Studentships are open to all British subjects. Conditions of tenure of Exhibitions.

The National Scholarships are only open to students who belong to one of the categories (*a*), (*b*), (*c*), (*d*), (*e*) of § XXXII. sec. iii. Scholarships, and Free Studentships.

All the Exhibitions, Scholarships, and Studentships are held on the condition that the holder attends the courses of instruction regularly, complies with all the rules laid down for his guidance, and passes the examinations required for the associateship.

Private students who have been for more than one session in the Royal College of Science, London or Dublin, Local Exhibitioners, and Science teachers in training, are not eligible for Royal Exhibitions, National Scholarships, or Free Studentships.

Competitors for Royal Exhibitions, National Scholarships, or Free Studentships must send in Form No. 330*a* before the 15th April, and Form No. 400 before the 10th June.

Calculation of results in the competition for Royal Exhibitions, &c.

34. The competition for the Royal Exhibitions, the Free Studentships, and for half of the National Scholarships, is determined as follows :—

The maximum number of marks obtainable in each subject, except Mathematics, is in the

Elementary stage - - -	100
Advanced stage - - -	200
Honours - - - -	400

with half the above maximum marks for practical Chemistry or practical Metallurgy or the practical Honours Examinations specified in sec. 10, p. 29, in addition to those for the Theoretical division of the same subject.

In Mathematics the numbers are in the

1st stage - -	100	
2nd „ - -	200	
3rd „ - -	300	Honours 500
4th „ - -	150	
5th „ - -	300	Honours 500
6th „ - -	300	
7th „ - -	400	Honours 600

But the number of marks gained by the candidate in each subject in the elementary stage (or in the 1st stage in Mathematics) is diminished by 50 per cent., and the number of marks gained in the Advanced Stage by 40 per cent., and in Honours by 30 per cent. of the total marks obtainable in the respective stages.

The remainder are then added together to determine the candidate's position.

But no candidate is awarded a Royal Exhibition, National Scholarship, or Free Studentship who has not obtained in Mathematics at least 60 per cent. of the total number of marks obtainable in the 1st stage or a second class in some higher stage or in Honours. This success may have been obtained in a previous year, but no marks are counted except for successes obtained in the current year.

The competition for the moiety of the National Scholarships excepted from the preceding rules will be decided by giving five scholarships each year to the Candidates who obtain the highest aggregate marks in Physics and Chemistry (Subjects 8, 9, 10, 10*p*, 11, and 11*p*); four to the Candidates who obtain the highest aggregate in Mechanics (Subjects 1, 2, 6, 7, and 22); and two to

the Candidates who obtain the highest aggregate in Human Physiology, General Biology, Zoology, and Botany (Subjects 14, 15, 16, and 17): provided that they have obtained, in the current or in some previous year, at least a first class in the elementary stages of one division of Theoretical Mechanics (Subject 6*a* or *b*), of Physics (Subjects 8 and 9, or Alternative Physics), Chemistry (Subject 10*p* and in 10, or Alternative Chemistry), and Mathematics, Stage 1.

Whitworth Exhibitions and Scholarships.

WHITWORTH SCHOLARSHIPS.—Sir Joseph Whitworth's Exhibitions and Scholarships are also awarded in competition at the May examinations. Candidates for Whitworth Exhibitions and Scholarships must register their names as competitors by sending in Form No. 330 before 15th April, and send in Form No. 400 before the 10th June. Further details with regard to these Scholarships will be found in the Whitworth Prospectus, which may be obtained from the Department, price 5*d*. [*See* list of publications at end of Directory.]

GRANTS AND PRIVILEGES ALLOWED TO TEACHERS.

Summer courses for teachers.

35. Arrangements are made to enable a certain number of Science teachers to attend courses of instruction in Science in the Royal College of Science at South Kensington, in the month of July. The teachers selected to attend any of these courses receive Third Class railway fare and 3*l*. towards their expenses while attending the College on condition that they comply with the rules. In the case of teachers resident in London or its vicinity a reduction is made in the personal allowance.

Information as to the precise period of these courses is circulated to Science Schools about April.

Studentships in Training at South Kensington.

36. A limited number of Teachers, and of Students in Science Classes who intend to become Science Teachers, are admitted free to the sessional courses of instruction in the Royal College of Science. They receive a maintenance allowance of 21*s*. per week while under instruction, and third class railway fare for one journey to and fro each session between the home of the teacher or student and the Royal College of Science. In certain special cases the allowance to Science Teachers in training may be increased to a sum not exceeding 30*s*.

Candidates for these Studentships in Training must send in Form No. 400 before the 10th June, and Form No. 1019 before the 1st July. The prospectus of the Royal College of Science will be found at p. 41.

Science Teachers who are sent abroad, or who travel in the service of the Department, receive 10*s*. a night while absent from home, second class railway fare, and cab or omnibus fares.

Assisted Studentships at Provincial Colleges.

37. Aid is granted to a limited number of teachers engaged in science teaching who are selected to attend instruction at Provincial Science Colleges. Particulars of the courses of instruction and of the nature and conditions of the Department's assistance are given for the Owen's College, Manchester, in Form

No. 988; for Sir Josiah Mason's College, Birmingham, in Form No. 1126; for the Firth College, Sheffield, in Form No. 1136; for the Yorkshire College, Leeds, in Form No. 1165; for the University College, Dundee, in Form No. 1193; for the University College, Nottingham, in Form No. 1195; for the University College, Cardiff, in Form No. 1243; for University College, Bristol, in Form No. 722; for the University of Aberdeen in Form No. 487; for the Durham College of Science, Newcastle-on-Tyne, in Form No. 484; University College of Wales, Aberystwith, in Form No. 826; St. Andrew's College, in Form No. 226; and for University College of North Wales, Bangor, in Form No. 963.

Application to attend Sir Josiah Mason's College or University College, Nottingham, must be made on Form No. 985. Application to attend any of the other Colleges on Form No. 985*b*. No application received later than 20th August will be considered. The selection of the applicants rests with the Department.

When an application is granted the applicant will receive Form No. 997 and is required to give the undertaking on Form No. 996.

Visits of classes to Museum.

38. Facilities will be given to Science teachers bringing their students to the South Kensington Museum, to examine the collections. When a teacher desires to avail himself of this privilege the Secretary of his school should write to the Department at least one week prior to the intended visit, stating the number of students by whom the teacher will be accompanied, the proposed date and hour of the visit, and the collection of apparatus which it is desired to inspect. The apparatus is available from 10 a.m. to 4, 5, or 6 p.m., according to the time of the year. It cannot be inspected in the evening or on a Bank Holiday.

Admission of Science Teachers to Lectures.

39. Any *bonâ fide* Teacher who is qualified to earn payments on results, *and who is actually engaged in teaching, or who has recently taught approved Science classes under the Department*, may attend, without the payment of any fee, any course of lectures at the Royal College of Science, London; or at the Royal College of Science, Dublin, as far as there may be room. Application for this privilege should be made to the Registrar, Royal College of Science, London, or to the Secretary of the Royal College of Science, Dublin.

NOTE.—Science Form No. 170 (see page 101) gives specific instructions as to the dates for making returns, &c. Special attention is called to these and to the concluding paragraph.

Application for any of the forms alluded to in this Directory should be made to the Secretary, Department of Science and Art, London, S.W.

Official communications should be written upon foolscap paper and sent in envelopes addressed to the Secretary, Department of Science and Art, London, S.W. The postage need not be prepaid, and it is particularly requested that Post Cards and Correspondence Cards may not be used.

The Royal College of Science, London.*

Object of the Royal College of Science.

1. The Royal College of Science at South Kensington is an institution supported by the State to supply systematic instruction in the various branches of Physical Science to students of all classes. While the College is primarily intended for the instruction of Teachers, and of students of the industrial classes selected by competition in the examinations of the Department of Science and Art, other students are admitted so far as there may be accommodation for them (*see* p. 43, sec. 10), on the payment of fees fixed at a scale sufficiently high to prevent undue competition with institutions which do not receive State aid.

Royal School of Mines.

2. The Royal School of Mines is incorporated with the Royal College of Science. Students entering for the Associateship of the School of Mines obtain their general scientific training in the Royal College of Science.

Administration of the Royal College.

3. The Royal College of Science is administered by a Council consisting of the Professors, with a Dean as Chairman, and a Registrar.

Course of instruction.

4. The instruction in the Royal College of Science is arranged in such a manner as to give the students a thorough training in the general principles of Science, followed by advanced instruction in one or more special branches of Science.

Associateship students.

5. The Associateship is granted in certain divisions or lines of study. Students who go through any one of these divisions taking the subjects of instruction in the prescribed order and who pass the necessary Examinations receive a Certificate of Associateship of the Royal College of Science, or of the Royal School of Mines.

Other students.

6. Students who are not candidates for the Associateship are permitted to enter as occasional students, and to take up the course of instruction in one or more special branches of Science, and on passing the examinations receive a Certificate to that effect. Certificates are not given for Model and Freehand Drawing, nor for Mathematics, except in the higher classes, namely, C, D, and E.

Royal College of Science Associateship.

7. The Associateship of the Royal College of Science is given in one or more of the following divisions—

I. Mechanics.
II. Physics.
III. Chemistry.
IV. Biology
V. Geology.
VI. Agriculture,

Royal School of Mines Associateship.

and the Associateship of the Royal School of Mines in—

VII. Metallurgy.
VIII. Mining.

* The title was changed from "Normal School of Science" on the 25th October, 1880.

Division of the three year course.

8. The course of instruction, which lasts for three years, is the same for all the divisions during the first year, after which it is specialised in accordance with the Scheme given below, where the fee for each section of the course is also stated.

9. A student obtains the Associateship who passes in all the subjects of the first two years and in the third year those of the special division he selects for his Associateship.

The obligation to go through the Elementary, or First Part in any of the following courses, may be remitted in the case of any Student who satisfies the Council that he has received sufficient theoretical and practical instruction in those subjects.

Associateship Course.

1st YEAR.

First Term.	Second Term.
Chemistry (Part I.) 16*l.*	Physics (Part I.) 17*l.*
	Astronomical Physics, 5*l.*

Mathematics (3*l.* per Term) and Freehand and Model Drawing (1*l.* per Term) throughout each Term.

2nd YEAR.

First Term.	Second Term.
A. Mechanics 10*l.* and Machine Drawing (Part I.) 3*l.*	Elementary Geology and Mineralogy 12*l.*
B. Elementary Biology 17*l.*	

A. For Students who take the Associateship in Divisions I., II., III., VII., or VIII.

B. For those who take the Associateship in Divisions IV., V., VI.

Instruction in Mathematics 3*l.* per Term, so far as may be necessary, and in Descriptive Geometry throughout both Terms 3*l.* for the Session.

Note.—Descriptive Geometry is an optional subject for those students who take B.

3rd YEAR.

I. Mechanics.

First Term.	Second Term.
Mechanics (Part II.) 8*l.*	Mechanics (Part III.) 8*l.*
Mathematics 3*l.*	Mathematics 3*l.*
Machine Drawing 3*l.*	Machine Drawing 3*l.*

II. Physics.

Physics (Part II.) 12*l.*	Physics (Part III.) 12*l.*

III. Chemistry.

First Term.	Second Term.
Chemistry (Part II.) 16*l.*	Chemistry (Part III.) 16*l.*

IV. Biology.

A. Zoology (Part II.) 12*l.*	Zoology (Part II.) 12*l.*
B. Botany (Part III.) 12*l.*	Botany (Part III.) 12*l.*

V. Geology.

Geology (Part II.) 8*l.*	Geology (Part III.) 8*l.*

VI. Agriculture.

Mechanics (Part I.) 10*l.*	Agricultural Chemistry 13*l.*
Principles of Agriculture 4*l.*	

VII. Metallurgy.

Metallurgy lectures (Part I.) 2*l.*	Metallurgy lectures (Part II.) 2*l.*
Assaying, with determinative Mineralogy 13*l.*	Assaying 13*l.*

VIII. Mining.

Mining lectures 4*l.*	Mining lectures.
Metallurgy (Part I.) 2*l.*	
Assaying, with determinative Mineralogy, 13*l.*	Mine Surveying, 10*l.*

No student can take the double Associateship in Mining and Metallurgy in the same year unless he satisfies the Council at the commencement of the third year's session that his previous training in one or both of those subjects is such as to warrant a departure from the ordinary rule.

Admission of Students.

10. Application for admission must be made on Form 1289, and be sent to the Registrar before the end of May for admission in the first term in October, or before the end of December for admission in the second term. In this form a statement should be given of the studies which the applicant has already pursued, the examinations he has passed, and the names of a teacher or teachers to whom reference may be made. This application will be considered by the Dean and Council of the College, who will decide whether or not the candidate can be admitted.

This paragraph applies to private, *i.e.*, fee-paying students, only. The regulations as to the admission of State-aided students are contained in paragraphs 24 to 32.

Form 1289 can be obtained on application to the Registrar.

Conditions of admission of private students to the College.

11. Without some preliminary knowledge of Mathematics, Mechanics, Chemistry, and Physics it is not possible for Students to follow the courses with advantage. No private or fee-paying Student will, except under very special circumstances, be entered for the Associateship Course unless he has obtained a pass in the Elementary Stage of Mathematics, Mechanics, Chemistry, and Physics, or in some higher stage of those subjects, at the May Examinations of the Department of Science and Art, or can show to the satisfaction of the Council of the College, by having passed the Examinations of other recognised Institutions or examining bodies, that he possesses the necessary elementary knowledge of those subjects, while for occasional students who desire only to take up certain specific branches of Science some preliminary knowledge of Mathematics will be required.

Lectures.

12. Admission is granted to persons desirous of attending certain courses of the lectures, without the laboratory instruction, on payment of the lecture fees.

Laboratory fees.

13. Students who do not wish to attend the lectures are admitted for short periods to the laboratories, at the discretion of the Professors. The fees for the laboratories are 4*l.* per month.

Persons admitted at half fees.

14. Officers of the Army, Navy, and Civil Service, recommended by their respective Departments, are admitted to the Lectures and Laboratories at half fees.

Rules for admission of teachers.

15. *Bonâ fide* teachers qualified to earn payments for teaching Science according to the rule of the Science and Art Directory, and who are actually engaged in teaching, may obtain permission to attend free any course of lectures.

Privileges of associates.

16. Associates of the Royal College of Science or of the Royal School of Mines have the privilege of free admission to the Library and to all the courses of lectures.

Division of session.

17. The Session is divided into two Terms. The first Term begins on the 3rd October and ends about the middle of February. The second Term begins in the middle of February and ends about the middle of June. The Christmas and Easter Holidays.

Holidays each last about eight days.

Hours of study.

18. The hours of study are from 10 a.m. to 1.15 and from 2 to 4 p.m. every day, except on Wednesday and Saturday, when the College closes at 1 p.m.; students receiving instruction in Mathematics attend till 5 p.m. on the specified days.

Both the private and the State-aided students are required to furnish themselves with certain instruments and apparatus before the commencement of the courses. These are enumerated in the syllabuses of the several subjects.

Every Student will be required to conform to the rules of the College, to exhibit due diligence in his studies throughout the courses, and to give evidence of satisfactory progress at the different examinations, failing which, or in the event of misconduct, he will not be allowed to remain at the College (*Extracts from regulations to be observed by students*).

Fees.

19. The Fees of Students entering for the Associateship are given, for greater convenience, at page 42, from which it will be seen that for the first two years they amount to about 75*l.*, and for the remainder of the course for the Associateship they vary from 30*l.* to about 40*l.* Students not entering for the Associateship are admitted to any particular course of study, so far as there is room, on payment of the fees, as shown in the following table:— Fees.

Chemistry, Inorganic, Lectures, 3*l.*
„ Organic, Lectures, 3*l.*
„ Laboratories, per term, 13*l.*
Physics, Elementary, Lectures, 5*l.*
„ Laboratories, per term, 12*l.*
Biology, including Botany, Lectures, 5*l.*
„ Laboratories, per term, 12*l.*
Geology, including Mineralogy, Lectures, 4*l.*
„ Laboratories, per term, 8*l.*
Mechanics, Lectures, 4*l.*
„ Elementary Class Work, per term, 6*l.*
„ Advanced, 8*l.*
Metallurgy, Lectures, per term, 2*l.*
„ Laboratories, per term, 13*l.*
Principles of Mining, Lectures, 4*l.*
Mine Surveying, 10*l.*
Principles of Agriculture, Lectures, 4*l.*
Agricultural Chemistry, per term, 10*l.*
Astronomical Physics, Lectures, 2*l.*
Astronomical Physics, Laboratories, 3*l.*
Descriptive Geometry, 3*l.* per session.
Mathematics and Machine Drawing, 3*l.* each per term.
Model and Freehand Drawing, 1*l.* per term.
N.B.—In all cases fees must be paid in advance.

Examinations.

20. Examinations are held at the end of each course of instruction and at such other periods as may be found necessary. These examinations will be conducted by the Professors conjointly with examiners appointed by the Department of Science and Art. On the results of these examinations the successful candidates who have attended regularly and otherwise conformed to the rules of the college are arranged in two classes, first and second. Examinations.

SCALE OF MARKS AUTHORISED FOR THE EXAMINATIONS IN THE SUBJECTS OF THE FIRST TWO YEARS.

Mathematics	Class A.	10
	„ B.	15
	„ C.	30
	„ D.	45
		100

1ST YEAR.

FIRST TERM.		SECOND TERM.	
Chemistry (Part I.)	100	Physics (Part I.)	90
Mathematics, according to scale.		Astronomical Physics	10
		Mathematics, according to scale.	

Model and Freehand Drawing - 10

2ND YEAR.

FIRST TERM.		SECOND TERM.	
A. Mechanics and Machine Drawing (Part I.)	100	Geology, Elementary	70
		Mineralogy	30
B. Elementary Biology	100	Mathematics, according to scale.	
Mathematics, according to scale.			

Descriptive Geometry - 20

21. There are also "Honours" examinations for the subjects of the third year, the successful candidates being placed in order of merit.

"Honours" are only obtainable by candidates for the Associateship. No one will be allowed to attempt the Honours examination who fails to obtain a 1st Class in the ordinary examination.

The candidate for Honours will be required to pass an examination in some special branch or branches of one of the subjects in which the Associateship can be taken. The papers set will be of a more advanced character than those in the ordinary Associateship Examination.

The candidate will also be required to present a Thesis on some special subject, and great weight will be given to the adequate description of any original work or research which has been carried out by the student in one of the laboratories of the college with the sanction of the Professor.

For the Honours Examination in certain divisions the subjects will be as follows, and the student will only be required to take up one of them :—

DIVISION II.—PHYSICS.	DIVISION III.—CHEMISTRY.
Sound and Light.	Inorganic Chemistry.
Heat.	Organic Chemistry.
Electricity and Magnetism.	Chemical Physics.
Chemical Physics.	

The examination in Chemical Physics will be held jointly by the Professors of Chemistry and Physics.

DIVISION IV.—BIOLOGY.

ZOOLOGY.	BOTANY.
Anatomy and Histology	Physiology of Plants.
Development.	Anatomy and Histology.
Vertebrate Palæontology.	Morphology in relation to Classification.

Division V.—Geology.

Petrology. Stratigraphical Geology.
Invertebrate Palæontology.

Division VII.—Metallurgy.

Researches connected with the practical examination of a Metallurgical process or details of a process.
Theoretical Metallurgy.

Division VIII.—Mining.

Geological and technical description of some mine or mining district from personal study, with full details.

22. Students may be re-examined on payment of a fee of 1*l.* for each subject. Re-examination.

23. A student who goes through the prescribed course of instruction in any subject and passes the final examination in it receives a certificate to that effect as an occasional student. Certificates.

Royal Exhibitions, National Scholarships, and Free Studentships.

24 to 30. (See Science secs. 33 and 34.)

Teachers in Training.

31. (See Science sec. 36.)

Local Exhibitions.

32. (See §§ XXXV. and XXXVIII.)

REWARDS TO STUDENTS.

Royal Scholarships.

33. Four Scholarships, of 15*l.* each, are given to the students who have gained the greatest aggregate of marks in the examinations of the first year; and two Scholarships of 25*l.* to those pupils who have gained the greatest aggregate of marks in the examinations of the first two years. Royal Scholarships.

These Scholarships are held on the condition that the student attends the courses of instruction regularly, is examined, and passes satisfactorily.

The Scholar receives one moiety of his Scholarship at the commencement of the Session, and the balance at its conclusion, if the conditions have been satisfied.

Teaching Scholarships in Chemistry.

34. Two scholarships of 50*l.*, each tenable for one year only, will be awarded to two students in the Chemistry classes who take a high place in the final examinations of the Session, and who are otherwise, in the opinion of the Council, well qualified. Teaching Scholarships in Chemistry.

The holders of these Scholarships will be required to teach in the Chemical Laboratories during the ensuing Session.

The Edward Forbes Medal and Prize.

Forbes medal and prize.

35. The Trustees of the Edward Forbes Memorial Fund present a bronze medal and a prize of books, to be awarded to the student who does best in Biology.

The Murchison Medal and Prize.

Murchison medal and prize.

36. This medal and prize of books, the gift of the late Sir Roderick Murchison, is awarded annually to the student who does best in Geology.

The Tyndall Prize.

Tyndall prize.

37. The late Professor Tyndall having presented a sum of 100*l.*, the interest of which is to be given as a prize, books to that value are awarded to the student who does best in Physics, Part I.

The De la Beche Medal.

De la Beche medal.

38. This bronze medal, established in memory of Sir Henry De la Beche, is awarded annually to the student who does best in Mining.

The Bessemer Medal and Prize.

Bessemer medal and prize.

39. A bronze medal and a prize of books to the value of 5*l.*, given by Sir Henry Bessemer, are awarded annually to the student who does best in Metallurgy.

The Frank Hatton Prize.

Hatton prize.

40. A prize in memory of the late Frank Hatton, a student of this College, will be given to the student who does best in Chemistry.

The Warington Smyth Medal and Prize.

41. *A silver gilt medal, and the balance of the proceeds of a fund established in memory of Sir Warington Smyth, are awarded annually to the student who takes the first place in the Honours examination in mining.*

The award is only made if the Professors of Mining and Geology consider the candidate to have shown sufficient merit.

The Huxley Laboratory for Biological Research, and the Marshall Scholarship.

42. The research laboratory, which was founded to commemorate the long connexion of Professor Huxley with the School of Mines and the Royal College of Science, and is supplied with a valuable library given by him to the institution, is capable of accommodating two students. The occupants of this laboratory are required to undertake some branch of original research in Biology (Zoology, Botany, or Palæontology), under the superintendence of the professors and assistant professors in the Biological and Geological Divisions.

The Marshall Scholarship, which was founded by Miss Sarah Marshall in honour of her father, the late Mr. Mathew Marshall, of the Bank of England, is awarded annually to a student engaged in biological research in the Huxley Laboratory. The funds for this scholarship are supplied from the interest of about 900*l.* left by Miss Marshall for its endowment.

Prizes given by the Department of Science and Art.

Department prizes.

43. Prizes of books, each of the value of 3*l.*, are awarded by the Department of Science and Art to the students who do best in the following subjects:—Mechanics, Astronomical Physics, Practical Chemistry, Principles of Mining, Principles of Agriculture, and Agricultural Chemistry.

44. It rests with the Council to determine which of the candidates for the foregoing medals and prizes has done best. No candidate is allowed to compete for the same prize more than once.

Summer Courses for Teachers.

Summer courses.

See Science sec. 35, page 39.

Working Men's Lectures.

Working men's lectures.

46. Notification of these will be given in the newspapers.

For any further information apply to the Registrar, Royal College of Science, South Kensington, London, S.W.

GENERAL TIME TABLE OF SUBJECTS FOR THE SESSION 1894–1895.

When the Course consists of two or more parts these are indicated by the Roman Numerals I., II., or III., otherwise a × is put under the months.

—	Oct.	Nov.	Dec.	Jan.	Feb.		Mar.	April.	May.	June.
Chemistry	I.	I.	I.	I.	I.					
	II.	II.	II.	II.	II.	III.	III.	III.	III.	III.
Physics	II.	II.	II.	II.	II.	III.	III.	III.	III.	III.
						I.	I.	I.	I.	I.
Biology	I.	I.	I.	I.	I.	II.	II.	II.	II.	II.
	II. & III.	II. & III.	II. & III.	II. & III.	II. & III.	III.	III.	III.	III.	III.
Geology (including Mineralogy)	II.	II.	II.	II.	II.	I.	I.	I.	I.	I.
						III.	III.	III.	III.	III.
Astronomical Physics										×
Mathematics	×	×	×	×	×	×	×	×	×	×
Descriptive Geometry	×	×	×	×	×	×	×	×	×	×
Mechanics and Machine Drawing	I.	I.	I.	I.	I.					
	II.	II.	II.	II.	II.	III.	III.	III.	III.	III.
Metallurgy, with Assaying.	×	×	×	×	×	×	×	×	×	×
Principles of Mining	×	×	×	×	×	×	×	×		
Mine Surveying						×	×	×	×	×
Principles of Agriculture.	×	×	×	×						

The hours of study for all subjects except Mathematics and Drawing are from 10 to 1.15 and from 2 to 4 daily, except on Wednesday and Saturday, when they are from 10 to 1 only. Mathematics will be taught from 3 to 5 daily, except on Wednesdays and Saturdays. Model and Freehand drawing are taken during the 1st session, and Descriptive Geometry during the 2nd session, from 10 a.m. to 1 p.m. on Saturdays. The session opens 3rd October 1894.

Rules for Science Classes in Training Colleges under the English and Scotch Education Departments.

The following Rules are modified for the Examinations of 1895. Particulars of the Modifications will be found on page 53.

Examinations.

1. An Examination in certain branches of Science will be held in Training Colleges immediately before the annual Examination held by the Education Department. All payments for instruction in Science in Training Colleges are made on the results of this Examination.

2. The Examination is for the students in the Training Colleges and is not open to Acting Teachers. It is held in those subjects only for which a special course of instruction is provided in the time-table of the College, and is conducted by one of Her Majesty's Inspectors, or by an officer of the Department of Science and Art. No Student in a Training College is allowed to attend the May Examinations of the Department of Science and Art.

Local Committees are not required for the Training Colleges; such returns as are necessary being made by the Principal. *Before 10th February in each year the Principal should furnish on Form No. 120A particulars of the Teaching Staff and Time Table of Instruction under the Department of Science and Art. Changes which are made subsequent to this return should be reported to the Department.*

Subjects of examination.

3. The Examination is confined to the following subjects of Science:—

1. Practical Plane and Solid Geometry (Elementary Stage. Subject I.
2. Mathematics. Subject V.
3. Theoretical Mechanics; (*a*) solids; (*b*) fluids. Subject VI.
4. Applied Mechanics. Subject VII.
5. Sound, Light, and Heat (Elementary Stage), and, in the Advanced Stage or Honours, (*a*) Sound, (*b*) Light, (*c*) Heat; or

5 (*a.*) Alternative Physics. Subject VIII.

6. Magnetism and Electricity. Subject IX.
7. Inorganic Chemistry (Theoretical), Inorganic Chemistry (Practical). Subjects X. and X.*p*.
8. Human Physiology. Subject XIV.
9. Botany. Subject XVII.
10. Physiography. Subject XXIII.
11. Principles of Agriculture. Subject XXIV.
12. *Hygiene. Subject XXV.*

4. The course of instruction in each subject is intended to cover two years in the Training College unless the student has

previously studied the subject. No student is allowed to attempt the paper for the Advanced Stage or for Honours, in any subject other than Mathematics, unless he has previously been successful, at the May Examination or at the Training College, in at least the Elementary Stage of the subject, *or has been recorded "Fair" at Examination in the Elementary Stage.* No student is permitted to take up the Advanced Stage of more than two subjects, in addition to the Elementary Stage of Science Subject I., but, *in addition to the Advanced Stage of one subject,* the Elementary Stage of two subjects may be taken instead of the Advanced Stage or Honours of *a second* subject.

The two divisions of Mathematics are together considered as one subject in the interpretation of this rule, but Division *a* or *b* of VI., and Division *a*, *b*, or *c*, of the Advanced Stage of VIII. is each considered a separate subject.

Instruction in Chemistry.

5. Practical instruction must in all cases form a part of the teaching of Chemistry in Training Colleges. No grants are made to any College on the results of examination in Chemistry unless it be furnished with a Laboratory and Apparatus satisfying the requirements detailed at p. 200; and it is necessary that each student, on whom payment is to be claimed, should himself perform, previous to his examination, the more important and characteristic of the experiments.

6. The Examination, except in Mathematics, is based on the syllabus of the several subjects (pp. 145, 161, 165, 167, 176, 180, 184, 186, 198, 218, 228, 251, 253, 261); and papers are set in the three stages, Elementary, Advanced, and Honours, as at the May Examination. Questions are also set on the method of teaching various branches of the subject. The syllabus for the Mathematical Examination is given (in § 12).

7. The successful students are classed as at the May Examinations (*see* p. 26).

Certificates.

8. All students who pass receive certificates, but no prizes are given. The students who obtain a First Class in the Advanced paper or pass in Honours are registered as qualified to earn payments on results.

Payments on results.

9. The payments are 1*l.* 10*s.* for a pass in the Elementary Stage of any subject; for a first or second class in the Advanced Stage 3*l.* and 1*l.* 10*s.* respectively; and for a first class or second class in Honours 5*l.* and 2*l.* 10*s.* respectively. These are subject to the same deductions (except in the case of Mathematics, in which the deductions are stated below, *see* § 14), as those made on the results of the May Examinations, viz.:—

No payment is made on account of a student who has been previously successful in a higher stage of the same subject.

If the student has been previously successful in the same stage of the same subject, either at a Training College Examination or at the May Examinations, the payment on his account will be reduced by the payment which would be claimable on such previous success.

For instance, the payment of 5*l.* for a first class in the advanced stage would, if the student had previously taken a second class in that stage of the same subject, be reduced by 2*l.* 10*s.*

No deduction is made in the payment for the first stage of Subject I. on account of a previous payment for section 1 of that subject.

Mathematics Syllabus.

10. In addition to the payments for Theoretical Chemistry, payments are made for Practical Chemistry of the same amounts and on the same conditions as those detailed for the May Examinations in sec. 14, p. 30.

11. The examinations are held in November or December, and extend over five days.

12. The following is the Syllabus for Mathematics in Training Colleges:—

DIVISION 1.

GEOMETRY.—All the propositions of Plane Geometry, including the doctrine of proportion, so far as it is treated in the definitions of the fifth and in the sixth book of Euclid.

ALGEBRA.—Up to indeterminate coefficients and continued fractions.

LOGARITHMS.—

TRIGONOMETRY.—So far as it is required for the measurement of triangles, areas, heights, and distances.

SOLID GEOMETRY.—First principles, including the volume and surface of the right cylinder, cone, and sphere.

A Student who passes in this division is registered as qualified to earn payments on results in Stages 1, 2, 3, and 4, of Mathematics.

DIVISION 2.

DIFFERENTIAL CALCULUS.—Definitions. Limits. Differential coefficients. Differentiation of simple functions, of inverse functions. Successive differentiation of functions of one variable. Taylor's and Maclaurin's Theorems and their simpler applications. Determination of values of functions when indeterminate in form. Differentiation of a function of a function and of implicit functions. Maxima and minima of functions of one independent variable.

INTEGRAL CALCULUS.—Meaning of definite and indefinite integration. Integration of the more frequently occurring functions. Integration by parts. Rational fractions. Formulæ of reduction.

A student who passes in this division is registered as qualified to earn payments on results in all the stages of Mathematics.

13. One division of Mathematics may be taken each year, or the two divisions may be taken in one year. There are two classes in each division. Payments of 1*l.* and 2*l.* are made in each division for a Second and First class respectively. If a student obtains a First class in both divisions he is awarded an "Honours" certificate.

14. In Division 1 of Mathematics the reductions on account of previous success at the May Examinations will be 10*s.* for 2nd Stage, 1*l.* for 3rd Stage, 10*s.* for 4th Stage, and 1*l.* for 5th Stage. The deductions from payments in Division 2 are 10*s.* for previous success in Stage 6 and 1*l.* for previous success in Stage 7.

No payment will be made on account of successes at the May Examinations in the Elementary or Advanced Stage of any subjects of Science obtained by Candidates who were successful at the Training College Science Examinations between the years 1878 and 1887 inclusive, or at those examinations held under the "old" rules in 1888 or 1889. The usual payment will, however, be made for success in Honours.

As regards Mathematics, Candidates who have passed under the former Training College rules or under Stage 1 of the present rules will only be paid on in Stage 5, Honours of Stages 4 and 5, Stage 6, Stage 7, and Honours of Stages 6 and 7 at the May Examinations. Candidates who have passed Stage 2 of the present Training College rules will not be paid upon for success at the May Examinations.

In view of the fact that the Examination will take place in July (instead of December) 1895, the foregoing regulations are, for the Session 1894–5, specially modified as follows:—

The subjects of Science for which marks may be obtained are unaltered, but no candidate may obtain marks for more than ONE *subject in the Advanced Stage or Honours, or* TWO *subjects in the Elementary Stage, in addition to Section I. of the Elementary Stage of Subject I., Practical Plane and Solid Geometry, which will, for this shortened session only, be substituted for the full Elementary Stage; payment of* 10*s. being made for a success therein.*

In Mathematics in Division I. the syllabus will be taken as far as logarithms inclusive. In Division II. the syllabus will be the same as at present, but the examination questions will be of an easier character. The number of marks obtainable will be so adjusted that in the return made by the Department of

Science and Art to the English and Scotch Education Departments, the position of the students will not be adversely affected by the restricted examination.

Training Colleges in Ireland.

Training Colleges in Ireland.

Students of Training Colleges in Ireland may be examined and earn payments on results in Science Subjects, provided that the Authorities of each College examined employ a duly qualified Teacher.

In place of a Local Committee the College Authorities must supervise the Science instruction and make the necessary arrangements for the examinations under the rules for the May examinations. The Principal, who will act as Secretary, must make application for papers in Form No. 119 in accordance with § XXVII. (see page 11). The examinations will be conducted by an officer of the Department. Payments on results and the conditions attaching to such payments are the same as those which are stated in pars. 9 and 10 (see above).

Rules for Science Classes in Day Training Colleges under the English Education Department.

1. The correspondent of the Day Training College will be the Principal of the College, as in the case of a Residential Training College.

2. The Day Training College should return the Time Table of its lessons in Science annually on Form No. 120A before 1st November.

3. The Day Training College will not have to keep separate registers of students' attendance in Science instruction. It will be treated in the same way as regards payments on results as a Residential College; but its students will sit at the May examinations only.

4. The Day Training College may claim payments on the results of examination of its students at the May examinations, provided it makes the necessary arrangements for the examination of its students under the rules for the May examinations and applies to the Department, on Form No. 119, for the requisite examination papers by the prescribed date. The examinations may be superintended by the Committee approved by the Science and Art Department, or by the Committee under the Education Code.

5. As regards SCIENCE. Day Training College Students can only be examined in the Subjects allowed by the Education Department, namely :—

1. Practical Plane and Solid Geometry (Elementary Stage). Subject I.
2. Mathematics. Subject V.
3. Theoretical Mechanics ; (*a*) solids ; (*b*) fluids. Subject VI.
4. Applied Mechanics. Subject VII.
5. Sound, Light, and Heat (Elementary Stage), and, in the Advanced Stage (*a*) Sound, (*b*) Light, (*c*) Heat ; or

5A. Alternative Physics. Subject VIII.

6. Magnetism and Electricity. Subject IX.
7. Inorganic Chemistry (Theoretical), Inorganic Chemistry (Practical). Subjects X. and X.*p*.
8. Human Physiology. Subject XIV.
9. Botany. Subject XVII.
10. Physiography. Subject XXIII.
11. Principles of Agriculture. Subject XXIV.
12. Hygiene. Subject XXV.

and the number of subjects in which they can be examined is limited to the number allowed by the Education Code to the Residential Training Colleges.

6. Where a Committee for the supervision of Science Classes in the building of a Day Training College has been recognised by the Department, the Day Training College Students will not be considered as forming part of those Classes, but will be treated separately as regards payments and returns.

Form No. 1234.

Special Regulations applying to Science Schools, Teachers, and Pupils in Ireland.

Formation of Science Schools.

1. When it is proposed to commence a Science School or Class in Ireland, Form No. 1104 should be at once forwarded to the Department of Science and Art by the gentleman who is to act as Secretary of the Local Committee, giving full particulars as to the place where the class is to be held, how the Local Committee will be constituted, the name of the teacher, and the subjects to be taught.

Unless Form No. 1104 be received before the 1st September, the Department may refuse to make payments on the results of the next examination. The acceptance of the form after that date is exceptional, and will be subject to a deduction from the grant.

2. No person teaching in a School under the Commissioners of National Education will be recognised as a teacher under the Department of Science and Art at any other School without special sanction.

Continuance of Science School.

3. When it is proposed to continue an existing Science School, each teacher of that School should forward Form No. 1160 to the Department of Science and Art. Unless this form be sent to the Department by a teacher before the 1st September, the Department may refuse to recognise the instruction given by him during the current session.

Time of examination.

4. The examination will be conducted by the Local Committee where no special superintendent is nominated by the Department, and where the Department selects certain members of the Local Committee for the duty they must conduct the examinations. In order that the examinations may be held simultaneously in Great Britain and Ireland they will commence in Ireland half-an-hour by Dublin time, earlier than the times stated on the Time Tables given at pp. 27, 28, 69, and 71.

Return necessary to secure payments.

5. Immediately after the Science examinations the Secretary of each Local Committee is required to make a return of the students of his Science School who have been examined. For schools under the Commissioners of National Education this return must be made on Form No. 945 and sent to the National Board Inspector for the district by the 10th June. For schools not under the Commissioners of National Education this return must be made on Form No. 945A and sent to the Secretary, Department of Science and Art, London, S.W., by the 10th June. No claim for payment on account of the success of any person whose name is not included in the list on Form No. 945 or 945A can be considered.

Restrictions in payments.

6. No payments are made on account of success in the elementary stage of Science Subject No. XX. (Navigation) or in the elementary stage of Science Subject No. XXI. (Nautical Astronomy) obtained by a pupil in any of the Navigation Schools belonging to the Commissioners, nor can the teachers of such schools claim such payments on account of any other pupils in these subjects.

Payments are made on account of students who pass in the higher stages of these subjects.

7. Teachers holding the Commissioners' certificates of the 1st or 2nd class are not paid upon as students of Science Schools when they pass in the 1st stage of Science Subject V. (Mathematics). Restrictions in payments.

8. Teachers holding the Commissioners' certificates of the 1st class are not paid upon as students of Science Schools when they pass in the 1st or 2nd stage of Science Subject V. (Mathematics), or in the elementary stage of either division of Science Subject VI. (Theoretical Mechanics), of Science Subject VIII. (Sound, Light, and Heat), or of Science Subject IX. (Magnetism and Electricity).

9. Teachers who hold the Commissioners' special certificates for Navigation are not paid upon when they pass in the elementary stage of Science Subject XX. (Navigation) or of Science Subject XXI. (Nautical Astronomy).

10. Teachers who hold the Commissioners' 3rd class certificate are not paid upon as students of Science Schools when they pass in the elementary stage of Science Subject XXIV. (Principles of Agriculture), and teachers holding 1st or 2nd class certificates are not paid upon when they pass in the elementary or advanced stages of the same subject.

11. Payments are made on account of teachers who pass in the higher stages of the subjects specified in the foregoing sections 7, 8, 9, and 10, and the restrictions in those paragraphs do not apply to female teachers.

12. No pupil or monitor in a school under the Commissioners of National Education who has not passed the Standard of the 2nd stage of the 5th class or been placed in the 6th class may be presented for examination by the Department of Science and Art, or registered, in any subject of Science: and no pupil or monitor who has not passed the Second examination of the 6th class may be presented for examination, or registered, in Subject XXIV., Principles of Agriculture.

No pupil in a school under the Commissioners of National Education who has been examined by an officer of the Commissioners since the previous 1st August in any subject, for an extra branch fee, may be presented for examination in that subject by the Department of Science and Art.

Any student who has made even one attendance at a National School since the 1*st August* preceding the examination of the Department of Science and Art is considered to be a pupil of that School for that year.

13. On receipt of Form No. 1104, or of Form No. 1160, the Department will send to the Secretary of the Local Committee Form No. 88 for its formal constitution (or if a Committee exists but has not received permanent recognition Returns to be made by schools.

Form No. 168 for its formal renewal) (*see* § IX.), together with Form No. 120 for particulars of the time-table, &c. (*see* § XVI.).

On receipt of the Form No. 120 the Department will, in order to avoid delay, send the requisite registers, but this must not be understood to imply the definite recognition of the Science School.

The following rules apply only to Science Schools established in schools under the patronage of the Commissioners of National Education in Ireland, or taught by their teachers, and to the pupils of those schools:—

Approval of arrangements.

14. If the Science Class is held in a school under the patronage of the Commissioners of National Education, or is taught by their teachers, the Department will place itself in communication with the Commissioners of National Education, and the Science Class will not be finally approved until the Commissioners have given their sanction, which will be communicated to the Secretary of the Local Committee.

Special qualification of teachers.

15. Teachers who hold the Commissioners' certificates of the 1st and 2nd class are considered qualified to earn payments on results from the Department of Science and Art in the 1st stage of Science Subject V. (Mathematics), and those who hold certificates of the 1st class to earn payments in the 1st and 2nd stages of that Subject.

16. Teachers who hold the special Navigation certificate of the National Board are considered qualified to earn payments on results in the elementary stage of Science Subject XX. (Navigation) and in the elementary stage of Science Subject XXI. (Nautical Astronomy).

17. Teachers who, previous to 1885, held a 3rd class certificate of the National Board in Agriculture, and who had at that date earned from the Department of Science and Art payments on results in the elementary stage of Science Subject XXIV. (Principles of Agriculture), will still be recognised as qualified to earn payments on results in the elementary stage of that Subject.

18. Teachers who, previous to 1885 held the Commissioners' certificates of the 1st or 2nd class and who had at that date earned payments from the Department of Science and Art in the elementary and advanced stages of Science Subject XXIV. (Principles of Agriculture) will still be exceptionally recognised as qualified to earn payments on results in the elementary and advanced stages of that Subject.

19. Only those teachers whose Committees have applied for their recognition in accordance with sec. 5*a*, page 25, can claim the advantage of the provisions of the above paragraphs Nos. 15, 16, 17, and 18.

Inspection.

20. In addition to the visits of officers of the Department of Science and Art the Inspectors of the National Board occasionally visit the Science Schools and note whether the rules of the Department are properly carried out. They also examine the attendance registers of the Science Schools and report to the Board, which will, when necessary, communicate with the Department of Science and Art.

Examinations.

21. The examinations of the Department of Science and Art are superintended and inspected by its officers and by the officers of the Commissioners. The Commissioners will decide the schools in which the examinations are to be conducted by their officers, who will take charge of the conduct of the examinations in as many as possible of their schools. Where no special superintendent is nominated the examinations will be conducted by the Local Committee, and where the Department selects certain members of the Local Committee for the duty, by such members. When an examination is conducted by an officer of the Commissioners one member only of the Committee of each class under examination need be present, but this only applies to cases in which the Officer of the Commissioners is present during the whole time of the examination, and not to cases of simple inspection. When a National Board officer is not available, the Secretary of the Committee is expected to attend each night with the other members of the Committee whose presence is required by the Department's regulations.

22. The officer of the Commissioners of National Education who conducts the examination is held responsible for seeing that the regulations of the Department are strictly complied with. If any irregularity should take place he will report the facts to the Department, when the Department's grant may be reduced or the examination may be cancelled and all payments withheld.

Limitation of examinations.

23. In a class held in a National School the number of pupils who may be presented for examination will be limited to the capacity of the school, and no such class can be examined at more than one centre.

CHAPTER III.

REGULATIONS SPECIAL TO ART.

PART I.

SCHOOLS OF ART AND ART CLASSES.

Art instruction and examinations.

1. Aid is given towards instruction in the following subjects of Art *:

Subject 1. LINEAR DRAWING BY AID OF INSTRUMENTS.
1*a*. Linear Geometry (including problems in Practical Plane and Solid Geometry and Graphic Statics).
1*b*. Machine and Building Construction and Naval Architecture—Drawings from copies.
1*c*. Linear Perspective.
1*d*. Architecture—Drawings from copies.
1*e*. Sciography.

Subject 2. FREEHAND OUTLINE DRAWING OF RIGID FORMS FROM FLAT EXAMPLES.
a. Objects.
b. Ornament (showing elementary principles of design).

Subject 3. FREEHAND OUTLINE DRAWING FROM THE "ROUND."
a. Models and objects. *b*. Ornament.

Subject 4. SHADING FROM FLAT EXAMPLES.
a. Models and objects. *b*. Ornament.

Subject 5. SHADING FROM THE "ROUND" OR SOLID FORMS.
a. Models and objects. *b*. Ornament.
c. Drapery. *d*. Time sketching and sketching from memory.

Subject 6. DRAWING THE HUMAN FIGURE, AND ANIMAL FORMS, FROM FLAT EXAMPLES.
a. In outline. *b*. Shaded.

Subject 7. DRAWING FLOWERS, FOLIAGE, AND OBJECTS OF NATURAL HISTORY, FROM FLAT EXAMPLES.
a. In outline. *b*. Shaded.

Subject 8. DRAWING THE HUMAN FIGURE, OR ANIMAL FORMS, FROM THE "ROUND" OR NATURE.
a. In outline from casts.
b_1. Shaded (details). b_2. Shaded (whole figures).
c_1. Studies of heads from the life.
c_2. Studies of the human figure from nude model.
d. Studies of drapery arranged on figure from antique or on the living model.
e. Time sketching.
f. Sketching from memory.

* A supplement to the Directory containing illustrations of "the Principal Stages of Art Instruction" is published—*price* 2*s*. 6*d*. [*See* List of Publications at end of Directory.]

Subject 9. ANATOMICAL STUDIES.
a. Of the human figure. *b*. Of animal forms.
c. Modelled from flat or examples in the round or relief.
d. Modelled from nature.

Subject 10. DRAWING FLOWERS, FOLIAGE, LANDSCAPE DETAILS, AND OBJECTS OF NATURAL HISTORY, FROM NATURE.
a. In outline. *b*. Shaded.

Subject 11. PAINTING ORNAMENT FROM FLAT EXAMPLES.
a. In monochrome } either in water-colour, tempera, or oil.
b. In colours }

Subject 12. PAINTING ORNAMENT FROM THE CAST, &c.
a. In monochrome, either in water-colour, oil, or tempera.

Subject 13. PAINTING FROM FLAT EXAMPLES—FLOWERS, STILL-LIFE, &c.
a. Flowers or natural objects, in water-colour, in oil, or in tempera.
b. Landscapes, or views of buildings.

Subject 14. PAINTING DIRECT FROM NATURE.
a. Flowers, or still-life, in water-colour, oil, or tempera without backgrounds.
b. Landscapes, or views of buildings. *c*. Drapery.

Subject 15. PAINTING (FROM NATURE) GROUPS OF STILL-LIFE, FLOWERS, &c., AS COMPOSITIONS OF COLOUR.
a. In oil colour. *b*. In water-colour or tempera.
c. In monochrome, or light and shade.

Subject 16. PAINTING THE HUMAN FIGURE OR ANIMALS IN MONOCHROME FROM CASTS.
a. In oil, water-colour, or tempera.

Subject 17. PAINTING THE HUMAN FIGURE OR ANIMALS IN COLOUR.
a. From the flat, or copies.
b. The Head or draped figure from nature.
c. The nude figure from nature. *d*. Time sketches.

Subject 18. MODELLING ORNAMENT.
a. From details, such as single ornamental devices, scrolls, &c.
b. From casts of ornamental compositions for pilasters, friezes, &c.
c. From drawings or photographs.
d. Time sketches from examples.
e. Modelling from memory.

Subject 19. MODELLING THE HUMAN FIGURE OR ANIMALS.
a. From hands, feet, &c.
b[1]. From heads or masks from the antique in the round; *i*. in relief.
b[2]. From the antique figure in the round; *k*. in relief.
c. From drawings. *d*. The head from nature (busts);
l. „ „ (in relief).
e. The nude figure from nature in the round; *h*. in relief.
f. Drapery from actual stuffs and not from casts.
g. Modelling from memory.

Subject 20. MODELLING FRUITS, FLOWERS, FOLIAGE, AND OBJECTS OF NATURAL HISTORY, FROM NATURE.

Subject 21. TIME SKETCHES IN CLAY OF THE HUMAN FIGURES, OR ANIMALS, FROM NATURE.

Subject 22. ELEMENTARY DESIGN.
a. Studies treating natural objects ornamentally.
b. Ornamental arrangements to fill given spaces in outline, monochrome or modelled.
c. Ornamental arrangements to fill given spaces in colour.
d. Studies of historic styles of ornament drawn or modelled.

Subject 23. DRAWINGS FROM ACTUAL MEASUREMENTS OF STRUCTURES, MACHINES, &c., APPLIED DESIGNS, TECHNICAL OR MISCELLANEOUS STUDIES.
a. Architecture and building construction—drawings from actual measurements, taken by the student, of existing structures.

b. Architecture and building construction—original designs.
c. Ornamental design as applied to decorative or industrial art.
d. Figure composition, and ornamental design with figures, as applied to decorative or industrial art.
e. and *f*. The same as 23*c* and 23*d*, but in relief.
g. Machine construction and naval architecture—drawings from actual measurements, taken by the student, of existing machines, ships, &c.
h. Machine construction and naval architecture—original designs.

2. The examinations in Art are—
(*a*) for Elementary Schools, see p. 86;
(*b*) for Training Colleges, see p. 99; and
(*c*) for Schools of Art and Art Classes, see pp. 69 to 73.

PREMISES, FITTINGS, APPARATUS, AND EXAMPLES.

Premises.

School of Art.

3. A School of Art must be under public management and held in rooms approved by the Department, which are wholly devoted to elementary and advanced instruction in Art. The school must be adequately supplied with apparatus and examples, and be always open for study and the inspection of the Art examples.

Detailed information in respect of Schools of Art must be sent to the Department in Form No. 527 upon the formation of Schools of Art, and as the Department may require.

Art Class.

4. An Art Class may be held in a Mechanics' Institute, School, or other Public Institution; but it must be adequately supplied with apparatus and examples for instruction.

Building Grants (*see* § XIII.).

Building grants.

5. Particulars as to the mode of application for a grant to build or adapt a building as a School of Art are given at p. 113.

Fittings and apparatus grants.

N.B.—Grants for fittings, apparatus, and examples are suspended, except in Ireland, while the Local Taxation (Customs and Excise) Act, 1890, *remains in force. The conditions under which such grants are made in Ireland are contained in Form No.* 48 *which can be obtained on application.*

TIMES OF MEETING FOR INSTRUCTION AND TEACHING STAFF.

Meetings of Classes in Schools of Art.

Times of meeting.

6. In Schools of Art both Day and Night Classes must be held, and there must be a Night Class for Artizans meeting under the instruction of the master for two hours at least three times a week during forty weeks in the year.

Branch Classes.

7. A branch Class of a School of Art may be formed, provided that it is taught by the master of the School of Art, or under his direction by a teacher holding the Art Class Teacher's Certificate, or an Art Master's Certificate, Group I.; that it has a Night Class for Artizans; and is in the same district and under the management of the same Committee as the School of Art. Branch classes of Schools of Art.

Qualification of Art Teachers.

8. A School of Art must be under the instruction of a teacher holding an Art Master's Certificate, Group I. (*see* p. 65). Schools of Art.

(*a.*) In cases of the master's illness, the Department may provide a substitute on condition that the Committee pay him 20*s.* a week during the time his services are required. No substitute so provided can remain longer than three months.*

(*b.*) Ex-National Scholars may be recognised as Teachers of Modelling, or of any special branch of Art which they are qualified to teach, in Schools of Art or Art Classes; but they cannot be recognised as Head Masters of such Schools or Classes unless they hold, respectively, the Art Master's Certificate, Group I. or the Art Class Teacher's Certificate.

9. An Art Class must be under the instruction of a teacher holding the Art Class Teacher's Certificate or an Art Master's Certificate (*see* pp. 64, 65). Art class.

(*a.*) Classes under the instruction of teachers holding either the Elementary School Teacher's Certificate D., the 2nd grade Drawing Certificate, or the new Elementary Drawing Certificate, (First Class), may be registered for payments on the results of the May examinations in the Elementary Stages of Subjects 2*b*, 3*a*, and 5*b*, *and Science Subject I.*: as well as for payments on results of the May Art examinations in the Elementary Stages of any other Art Subjects in which the Teachers have obtained a First Class in the Elementary Stage.

(*b.*) Classes under the instruction of Teachers holding either the Elementary School Teacher's Certificate D., or the 2nd grade Drawing Certificate, or of Teachers qualified to earn payments on results in Science Subject I. may be registered for payments on the results of the May examination in the Elementary Stage (only) of Perspective—Subject 1*c*.

Certificates.

10. There are three forms of Certificate for Art Teachers— Certificates.

(i.) The Elementary Drawing Certificate (First Class and Second Class);

(ii.) The Art Class Teacher's Certificate; and

(iii.) The Art Master's Certificate.

These several Certificates can be claimed when the examinations detailed in the succeeding paragraphs have been passed. In applying for his Certificate the Applicant must state when and where he passed the examinations.

Applicants for Certificates may be required to be re-examined in any subject in which they have passed more than three years previously. Re examination.

A teacher holding the Art Master's Certificate, Group IV. only, is not qualified for the Head Mastership of a School of Art. (*See* par. 8.)

Specially qualified persons may be exceptionally recognised.*

* *See p. 87 for certificate of special qualification to earn grants for Drawing in Elementary Schools.*

Elementary Drawing Certificate.

11. The requirements for the ELEMENTARY DRAWING CERTIFICATE (First Class) are a First Class in the Elementary Stage of:—

(*a.*) Freehand Drawing (Subject 2*b*);
(*b.*) Model Drawing (Subject 3*a*);
(*c.*) Shading from Casts (Subject 5*b*); and
(*d.*) A Pass in the Elementary Stage of Science Subject I.

Candidates who before the 1st January 1893 have obtained—

(i.) A pass in Geometrical Drawing, Section 1, Science Subject I., or a pass in 2nd Grade Geometry, and also a first Class in 2nd Grade Examination in Linear Perspective; or

(ii.) A pass in Geometrical Drawing, Section 1, Science Subject I., or a pass in the 2nd Grade Examination in Geometry, and now take a 2nd Class in the Elementary Stage of the new Examination in Perspective; or

(iii.) A 1st Class in the 2nd Grade Examination in Perspective, and now take a pass in Geometrical Drawing, Section 1, Science Subject I.;

will not be required to pass in the Elementary Stage of Science Subject I. to obtain the new Elementary Drawing Certificate.

(iv.) A pass in Model Drawing with chalk on the blackboard taken before 1st January 1893, will count for the new Elementary Drawing Certificate instead of a 1st Class in the Elementary Stage of Model Drawing (Subject 3*a*).

(v.) A pass taken before 1st January 1893 in Drawing in Light and Shade will count for the new Elementary Drawing Certificate instead of a 1st Class in the Elementary Stage of Shading from Casts (Subject 5*b*).

(vi.) A 1st Class taken before 1st January 1893 in the 2nd Grade Examination in Freehand will count for the new Elementary Drawing Certificate instead of a 1st Class in the Elementary Stage of Freehand Drawing of Ornament (Subject 2*b*).

(vii.) A 1st Class taken before 1st January 1893 in the 2nd Grade Examination in Model Drawing will count for the new Elementary Drawing Certificate instead of a 1st Class in the Elementary Stage of Model Drawing (Subject 3*a*).

12. The requirements for the ELEMENTARY DRAWING CERTIFICATE (Second Class) are—

(*a.*) a pass in the Elementary Stage of Science Subject I.;
(*b.*) a 2nd Class in the 2nd Grade Examination in, or the Elementary Stage of, Model Drawing (Subject 3*a*); and
(*c.*) a 2nd Class in the 2nd Grade Examination in, or the Elementary Stage of, Freehand Drawing (Subject 2*b*).

Art Class Teacher's Certificate.

13. For the ART CLASS TEACHER'S CERTIFICATE;

The satisfactory execution of the following works:—*

(*a.*) Subject 1*a*. Six or eight geometrical problems worked in ink with instruments; the problems being stated in writing. (On an imperial sheet.)

(*b.*) Subject 3*b*. An outline in pencil of ornament in low relief from the cast from the Madeleine or Louis XII. pilasters, or any large ornamental scroll. (On an imperial sheet.) Drawings from casts in relief of the same size as the originals may not be submitted for examination.

(*c.*) Subject 5*a*. A drawing from a group of models which should include vases such as those produced by Wedgwood or Minton, or similar objects *placed upon a drawing board*, drawn without background, and shaded in chalk or pencil. (On an imperial sheet.) *Enough of the board must be drawn to show that the Perspective is accurate. The horizon must be kept within the sheet of paper on which the models are drawn.*

* *See Supplement to Directory for illustrations of the character of these works.*

(*d.*) Subject 5*b*. A shaded drawing in chalk or pencil from a piece of ornament in high relief, or from casts of fruit. (On an imperial sheet.) Drawings from casts in relief of the same size as the originals may not be submitted for examination.

and a First Class in the :—

(*e.*) Elementary Stage of Perspective (Subject 1*c*).
(*f.*) Advanced Stage of Drawing in Outline from the Cast (Subject 3*b*).
(*g.*) ,, ,, Shading from Models (Subject 5*a*).
(*h.*) ,, ,, Drawing in Light and Shade from a Cast (Subject 5*b*), and
(*i.*) A Pass in the Elementary Stage of Science Subject I.*

14. For the ART MASTER'S CERTIFICATES :

Art Master's certificate.

These Certificates are only issued to Candidates who have obtained the Art Class Teacher's Certificate. The requirements for the Certificate, Group 1.—(Elementary Drawing, Colouring, and Design) are—

The satisfactory execution of the following works :—†

(*a.*) Subject 1*c*. Two Perspective problems stated in words and neatly worked in ink. (On an imperial sheet.)
(*b.*) Subject 1*d*. A sheet of the classic orders of architecture carefully inked in, and not less than three mouldings shaded in Indian ink or sepia. The orders must be named and the authority for each drawing given with a reference to the building from which it is derived. (On an imperial sheet.)
(*c.*) Subject 2*b*. A sheet of diagrams derived from Dyce's Drawing Book, Albertolli's Ornament, Jacobsthal's Grammatik der Ornamente, and instruction in the School, showing the application of the principles on which Foliated Design is constructed. Under each diagram must be stated the principle it illustrates. Copies of examples merely blocked in are not sufficient. (On an imperial sheet.)
(*d.*) Subject 8*a*. An outline of the Figure from the cast. (On an imperial sheet.) *The drawing should be a careful and accurate rendering of the contour of the figure and of such of the forms within the contour as can be rendered, or in some measure expressed, by a line.*
(*e.*) Subject 10*a*. A sheet of Foliage drawn in outline from a freely growing plant. (On an imperial sheet.)
(*f.*) *Subjects 14 and 22. A study, in colour, of a growing plant from nature, not pictorially represented (i.e., with accidents of light and shade), but simply and directly drawn, with details (separately if required) selected by the student as being characteristic of its growth and suggestive of ornament, together with three designs based upon the plant. These designs must occupy, in a decorative way, a square, a circle, and an oblong. One of them must be in monochrome, one in two colours, and one in polychrome. In each case the plant must be, not merely composed into the given space, but treated in accordance with decorative conditions. (On an imperial sheet.)*
(*g.*) *Subject 22b. A design in outline embodying the principles learnt in Subject 2b. (On an imperial sheet.) It is necessary that the ground be tinted with a wash of colour. The outline, which should be part of the design, must be executed with a broad pen or a brush.*

and a First Class in—

(*h.*) Architecture ; and
(*i.*) Principles of Ornament (Elementary Stage).

Female Candidates are not required to submit a work in Subject 1*d* nor to sit or th Examination in Architecture.

15. Certificates for the other Groups (II. to VI.) of subjects of Art instruction are also granted on passing the Examinations, the details of which are given at page 288.

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* *Privileges (i) to (iii) in par. 14, p. 64, are applicable to Candidates who have obtained successes towards the Art Class Teacher's Certificate.*

† *See Art Supplement to Directory (price 2s. 6d.) for illustrations of the character of these works.*

16. Irrespective of the above-mentioned Certificates, (Group II. to VI.), Candidates receive recognition on their Art Class Teacher's, or Art Master's, Certificate, if they send up a satisfactory work, and obtain a first class at the May examinations in the following sub-groups, while a student who has not taken a certificate receives a card showing his success in any of these subjects:—

Drawing from Antique.

(*a.*) Subject 8*b*². A shaded drawing of a complete figure from the Antique. (On an imperial sheet.)

(*b.*) { Drawing from an Antique figure, and Drawing the Antique from memory.

Painting in monochrome.

(*a.*) Subjects 11, 12, or 23. A Decorative Painting in Monochrome of an Ornament in grisaille on a coloured ground in oil or tempera. (On a sheet or canvas 30 ins. × 7 ins.)

(*b.*) Painting ornament in monochrome, in oil or tempera from a sketch or photograph.

Still life painting.

(*a.*) Subject 15*a*. A Study of a Group of Still Life or flowers, as a composition of colour, in oil. (On a canvas of half imperial size.)

(*b.*) Painting from Still Life.

Flower Painting.

(*a.*) Subject 15*b*. A group of Flowers painted from nature in water-colour. (On an imperial sheet.)

Ornament.

(*a.*) Subject 22*d*. A set of fifteen studies of Ornamental Design, showing the treatment of diapers, friezes, borders, panels, pilasters, &c., in colour or relief from original examples, either in the South Kensington Museum or elsewhere, THE AUTHORITY BEING GIVEN ON EACH SKETCH illustrative of the modifications evolved during various historic periods.

These studies should be coloured and shaded sufficiently to exhibit the treatment and modifications, and should not be highly finished specimens of still life painting.

Sections should be given of those parts of relief ornament which can be easily shown in that way, such as mouldings, and in the representation of embroidery, the direction of the stitching should be given.

Students in country schools may make their studies from works on Architecture or Ornamental Art, and should supplement them as far as possible from examples in local Museums and in churches or houses in the neighbourhood.

(*b.*) Principles of Ornament (Advanced Stage).

Design Ornament (Advanced Stage).

(*a.*) Subject 23*c*. A drawing of a flowering plant (such as that drawn in (*f*) for Group I.—see p. 65), together with three designs for patterns from it modified to suit the technical requirements of three different processes; for instance, embroidery, inlay, paper hanging, printed muslin, woven silk, painted tiles. The material must be named for each design. (These four drawings to be on an imperial sheet.)

b.) Design. Ornament (Advanced Stage).

Drawing from the life.

a. Subject 8*c*². A shaded drawing of a complete figure from the Life. (On an imperial sheet.)

b.) Drawing from the Life.

Anatomy.

a.) Subject 9*a*. (Two drawings.) (*a*) The Bones and (*b*) the Muscles placed within the outline of an Antique figure, or of a study from the life, or of one of the photographs from the nude figure by Michelangelo in the Sistine Chapel. (On imperial sheets.)

(*b.*) Anatomy.

Historic Ornament.

(*a.*) Subject 22*d*. Varied studies of Historic styles of Ornament, sufficiently extensive to represent the history of the styles selected, sketched from works in the South Kensington Museum, THE AUTHORITY IN EACH CASE BEING GIVEN. If they are from coloured ornament, the sketches are to be coloured also. (On two imperial sheets.)

These studies should be coloured and shaded sufficiently to exhibit the treatment and modifications, and should not be highly finished specimens of still life painting.

Sections should be given of those parts of relief ornament which can be easily shown in that way, such as mouldings, and in the representation of embroidery, the direction of the stitching should be given.

Students in country schools may make their studies from works on Architecture or Ornamental Art, and should supplement them as far as possible from examples in local Museums and in churches or houses in the neighbourhood.

(*b.*) Historic Ornament.

(*a.*) Subject 23*d*. A design of ornament and figures as applied to decorative or industrial Art. This design should be not less than 15 inches in its longest direction, and should be neatly executed in light and shade. It is essential that figures should form an important feature of the design. (On an imperial sheet.) Design Ornament (Honours).

(*b.*) Design—Ornament (Honours).

Subject 18*b*. A study of Ornament modelled from the cast. (On a panel 18 ins. by 24 ins.) Modelling Ornament.

(*a.*) Subject 19*b*. A model of an Antique figure, not less than 30 ins. high, either in relief or in the round. Modelling from the Antique.

(*b.*) Modelling from the Antique.

(*a.*) Subject 23*e*. A modelled design based on a flowering plant, together with three designs for patterns from it modified to suit the technical requirements of three different processes; as, for instance, carving, casting, wrought metal. The material must be named for each design. (Arranged on a panel 18 ins. by 24 ins.) Modelling Design Ornament (without the Figure).

(*b.*) Modelling, Design—Ornament (Advanced Stage).

(*a.*) Subject 19*e*. A model not less than 30 ins. high of the complete figure from the Life. Modelling the Figure.

(*b.*) Modelling in relief from the Life.

(*a.*) Subject 22*d*. Various drawings of the relief ornament of Historic styles drawn from the casts, carvings, metal work, &c. in the South Kensington Museum, WITH WRITTEN AUTHORITIES FOR EACH; and sufficiently extensive to represent the history of the various styles selected. (On two imperial sheets.) Historic relief ornament.

These studies should be coloured and shaded sufficiently to exhibit the treatment and modifications, and should not be highly finished specimens of still life painting.

Sections should be given of those parts of relief ornament which can be easily shown in that way, such as mouldings, and in the representation of embroidery, the direction of the stitching should be given.

Students in country schools may make their studies from works on Architecture or Ornamental Art, and should supplement them as far as possible from examples in local Museums and in churches or houses in the neighbourhood.

(*b.*) Historic Ornament.

(*a.*) Subject 23*f*. A modelled Design in relief of Ornament and Figures as applied to decorative Art. Modelling Design (including the Figure).

(*b.*) Modelling, Design—Ornament (Honours).

(*a.*) Subject 1*e*. A sheet of exercises in Sciography. (On an imperial sheet.) Perspective.

(*b.*) Perspective (Advanced Stage).

(*a.*) Subject 23*a* (1). A Measured drawing from a Building or portion of a building, with the Shadows accurately projected, and tinted. (On an imperial sheet.) Architectural drawing.

(*b.*) Science Subject III. (Building Construction), Elementary stage.

(*a.*) Subject 23*a* (2.) A Measured drawing in outline of an interior decorative detail, such as a tomb, a doorway, a choir stall, or the like, in stone, wood, or metal. (On an imperial sheet.) Architectural design.

(*b.*) Architectural Design.

REGULATIONS AS TO STUDENTS.

Registration.

Registration of lessons and attendances.

17. A Student may not be registered for lessons in more than two of the following groups of subjects bracketed together on any one day; nor for more than one lesson in any one Group—except on a Saturday, when lessons in three groups of subjects may be registered. *He may not be registered for a grant both under the rules for grants for Drawing in Evening Continuation Schools and under the rules for payments on results to Schools of Art or Art Classes.* (*See* Form No. 1069, p. 110.)

No Scholar receiving instruction at an Elementary School in the obligatory or standard subjects of the Education Code can be registered as a student of a School of Art or Art Class.

In order that payment may be claimed in any subject on account of a student he must have attended at least 20 lessons in the group which includes that subject; and to assist Local Committees in making their claims for payment, a reference is given against each group to the paragraphs regulating the payments under that group.

A. Drawing.	Freehand Drawing of Ornament (2*b* and 3*b*). Model drawing (3*a* and 5*a*). Drawing in Light and Shade from Casts (5*b*).	Payments under §§ 31*a*, *b*, and *d*.
B. Architecture.	Architecture (1*d*). Architectural design (23*b*). *Perspective (1*c* and 1*e*). Mechanical drawing (Subjects 1*b* and 23*a*).	Payments under §§ 31*a*, *b*, and *d*.
C. Theory and Designing.	Principles of ornament (22). Historic ornament (22*d*). Design—Ornament (Elementary and Advanced Stages) (23*c*).	Payments under §§ 31*a*, *b*, and *d*.
D. Painting.	Painting ornament in monochrome (11*a*). Painting from still life (15).	Payments under §§ 31*b* and *d*.
E. Study of the Figure.	Anatomy (9). Drawing and painting from the life (8*c* and 17). Drawing and painting from the antique (8 and 16). Design (Honours) (23*d*).	Payments under §§ 31*b*, *c*., and *d*.
F. Modelling.	Modelling from a Cast (18*a*). Modelling Design—Ornament (23*e* and 23*f*). Modelling from the Life (19*l*). Modelling from the Antique (19*i*).	Payments under §§ 31*a*, *b*, *c*, and *d*.

**Note.—Attendances in Science Subject I. qualify for payments on results of examinations in Perspective.*

EXAMINATIONS.

18 Time Table of Art Examinations in England, Scotland, and Wales.

Local personal examinations.

1895.

29th April,	Monday.	7 to 10 p.m.	Drawing in Light and Shade, Subject 5*b* (Elementary Stage).
		7 to 10 p.m.	Anatomy, Subject 9.
30th „	Tuesday.	7 to 8 p.m.	Model Drawing, Subject 3*a* (Elementary Stage).
		8.30 to 10 p.m.	Freehand Drawing of Ornament, Subject 2*b* (Elementary Stage).
1st May,	Wednesday.	7 to 9.30 p.m.	Freehand Drawing of Ornament, Subject 3*b* (Advanced Stage).
2nd „	Thursday.	6 to 10 p.m.	Drawing in Light and Shade, Subject 5*b* (Advanced Stage).
3rd „	Friday	6 to 10 p.m.	Perspective, Subjects 1*c* and 1*e* (Elementary and Advanced Stages).
4th „	Saturday.	6 to 10 p.m.	Drawing from the Life, Subject 8*c*[2].
6th „	Monday	6 to 10 p.m.	Design, Subjects 23*c* and 23*d* (Elementary and Advanced Stages, and Honours).
7th „	Tuesday	10 a.m. to 4 p.m. (See *Note* below.)	Painting from Still Life, Subject 15.
		7 to 9.30 p.m.	Model Drawing, Subject 5*a* (Advanced Stage).
8th „	Wednesday.	6 to 10 p.m.	†Drawing from the Antique, Subject 8*b*[2].
9th „	Thursday.	6 to 10 p.m.	Painting Ornament in Monochrome, Subject 11*a*.
10th „	Friday	7 to 10 p.m.	Principles of Ornament, Subject 22 (Elementary and Advanced Stages).
11th „	Saturday.	6 to 10 p.m.	Architecture, Subject 1*d*.
		7 to 10 p.m.	Historic Ornament, Subject 22*d*.
13th „	Monday	6 to 7 p.m.	Drawing the Antique from Memory, Subject 8*f*.
13th „ to 15th „	Monday to Wednesday. (See *Note* below.)	4 to 10 p.m.	Architectural Design, Subject 23*b*.

This Time-table is modified in Irish schools.

Note.— On the 7th, 13th, 14th, and 15th May, the six hours include half an hour for refreshment. On the 7th May the half hour must be taken by all Candidates from 1 p.m. to 1.30 p.m. On the other dates the half hour each evening must be taken by all Candidates from 7 p.m. to 7.30 p.m.

† The Examination in Drawing from the Antique is allowed only at centres of examination which have at least four full-size figures.

Where there is no Special Local Secretary (§ XXII.) a Member of a Committee may be paid a fee of half a guinea for the supervision of an Art Examination held in the DAY time or afternoon before 7 p.m. Of this fee one moiety must be contributed by the locality. When a certificate is received from the Chairman and Secretary of the Committee that a moiety has been lodged with them the Secretary will receive the other moiety from the Department. He must then pay to the Superintendent the full fee of half a guinea for the day's examination.

19. Pupil-teachers in Elementary Schools may not be examined in drawing *in the same subject in the same calendar year* both at the Elementary School and at the May Examinations (*see* p. 91, § 23). Restriction to examination.

20. Candidates who passed Second Grade Examinations in Freehand, Model, and Perspective Drawing in 1888 or previously are ineligible for re-examination for payments in respect of successes in the Elementary Stage of Freehand Drawing of Ornament (Subject 2*b*), Model Drawing (Subject 3*a*), and Perspective (Subject 1*e*).

21. The regulations for the conduct of Examinations in Art at Schools of Art and Art Classes in 1895 will be similar to those given in Form No. 965*c*, 1894 (*see* p. 135).

The Department may require from a Local Committee a payment of 2*s.* 6*d. for every paper worked by a candidate* (*and* 5*s. for every modelled work*) *which the examiner reports as obtaining less than* 25 *per cent. of the marks. A Local Committee may, therefore, call upon any candidate who against their wish, insists upon entering for examination in any subject to deposit* 2*s.* 6*d.* (*and* 5*s. for each Modelling Subject*), *to be returned if the Department does not require such payment from the Committee. External candidates may be required by the Local Committee or Special Local Secretary to make a similar deposit of* 2*s.* 6*d. for each subject of examination* (*and* 5*s. for each Modelling Subject*), *in addition to the usual examination fee.*

Examinations in Modelling.

Examinations in Modelling. Subject 18*a*.

22. Examinations in Modelling, Subject 18*a* (Elementary Stage), are held during the months of February to June only, by an officer of the Department. These examinations are held only in Schools of Art and in Art Classes which are under the instruction of a teacher holding the Art Master's Certificate, Group I., where a class for modelling has *received* at least 28 lessons in the 12 months preceding the date of examination, and there are 10 or more students in average attendance. The time allowed for the Examination is 2½ hours. No candidate may be presented for Examination who has not received 20 lessons at least.

23. The attendances made during the 12 consecutive months from the date of the previous Examination may be used in support of the claims for payments on the results of these Modelling Examinations (Elementary Stage).

24. For these Modelling examinations (Elementary Stage) in Subject 18*a* application must be made on Form No. 1175*b*, which must be sent in to the Department on or before 16th January, after which date no further applications will be admitted.

Combined examinations.

25. Local Committees of Schools of Art and Art Classes qualified as above, at which, however, less than 10 students are in average attendance at the instruction in Modelling, Subject 18*a*, may arrange amongst themselves to apply on a Form No. 1170 on or before 16th January for the combined examination of their students at one convenient centre.

26. Students who sit for examination in Modelling, Subject 18*a* (Elementary Stage), cannot in the same year send modelled works to London for examination.

Examinations in Modelling Subjects 19*h*, 19*i*, 23*e* and 23*f*.

27. Examinations in Modelling in Subjects 19*h*, 19*i*, 23*e* and 23*f* are held also at local centres where the Candidates sitting for examination in Modelling are themselves prepared to cast their own models, and where proper arrangements are made for them to do so.

Application for these examinations must be made in Form No. 119. (*See also par.* 21, *p.* 70, *as to fees chargeable to intending candidates.*) The dates of these examinations are as follow :—

1895.

16th May, Thursday and 17th May, Friday	4 to 10 p.m. (See *Note* below.)	Modelling from the Antique, Subject 19*i*.
18th „ Saturday.	Eight hours between 10 a.m. and 10 p.m.	For Candidates to Cast their Clay Models, Subject 19*i*.
20th „ Monday	4 to 10 p.m. (See *Note* below.)	Modelling. Design, Subject 23*e*. (Elementary and Advanced Stages).
21st „ Tuesday.	Eight hours between 10 a.m. and 10 p.m.	For Candidates to Cast their Clay Models Subject 23*e*.
22nd „ Wednesday to 24th May, Friday.	4 to 10 p.m. (See *Note* below.)	Modelling from the Life, Subject 19*h*.
25th „ Saturday.	Eight hours between 10 a.m. and 10 p.m.	For Candidates to Cast their Clay Models, Subject 19*h*.
27th „ Monday	4 to 10 p.m. (*See Note* below).	Modelling. Design, Subject 23*f*. (Honours).
28th „ Tuesday.		
29th „ Wednesday.	Eight hours between 10 a.m. and 10 p.m.	For Candidates to Cast their Clay Models, Subject 23*f*.

This Time-table is modified in Irish Schools.

Note.—On the 16th, 17th, 20th, 22nd, 23rd, 24th, 27th, and 28th May, the six hours include half an hour for refreshment to be taken by all Candidates from 7 p.m. to 7.30 p.m. The eight hours, including half an hour for refreshments, for Casting may be taken as convenient in the morning and afternoon, or the afternoon and evening of each day.

Works sent to South Kensington for Examination.

Works sent for examination to South Kensington.

28. Works on which payments under § 31*d*, p. 73, and prizes under § 36, p. 75, are to be claimed and works for Certificates must be properly labelled according to the instructions in Form No. 564, and must be sent not later than the 1st April from Science and Art Schools and Classes to South Kensington for examination. The best of these works will be selected to enter into a National Competition for medals and prizes (*see* pars. 36 and 37, p. 75).

National Competition.

Designs carried out in materials.

In addition to drawings, paintings, and modelled work done by Students in their Schools, designs carried out in various materials, such as earthenware, porcelain, glass, metal, wood, paper, leather, textiles, &c., may be submitted to fully illustrate or explain the original, drawn, painted, or modelled designs, which have been made by the Students as school works and are at the same time forwarded for examination. The limits of size prescribed in respect of school works apply also to the designs or portions of them executed in the appointed materials, and must be carefully observed. The designs executed in materials must be labelled, and distinctive special entries made of them under the students' names in the schedule of school works. Such executed designs will not be considered unless accompanied by the designs for them, drawn, painted, or modelled by the students as school work.

Some of the executed designs, with the original drawings, paintings, or models, may be admitted to the Exhibition of National Competition Works.

Exhibition of National Competition works.

29. The works admitted into the National Competition will be exhibited in London and in some of the more important provincial towns where suitable space can be provided.

30. A work which has been once submitted may not be again submitted.

(*a.*) The Department pays the carriage of works sent from Science and Art Schools and Classes.

(*b.*) The works *on which payments and prizes are to be claimed* must have been executed during the previous year in the School or Class during its recognised hours of meeting; and must be restricted to Drawings, Paintings, and Models. They should be more than preparatory exercises for a personal examination—something involving greater care in execution or instruction, and different from, or beyond what is tested and paid for under the rules for the personal examinations held locally.

Works of not more importance than Exercises done at the May examinations will not therefore be considered.

No painting from the figure, still-life, landscapes, and interiors, &c. exceeding 36 inches by 25 inches in size; no drawing exceeding an imperial sheet of drawing paper in size, *excepting in the case of Subject* 23 (*including all sub-divisions of this subject*) *for which the dimensions of each drawing on printing must not exceed* 48 *in. by* 48 *in.*, and no design exceeding 48 inches by 48 inches will be admitted to examination.

No modelled figure exceeding 36 inches in height; no modelled bust, group, or object exceeding 36 inches in height and 24 inches width at the base, and no modelled panel exceeding 36 inches by 24 inches will be admitted to the examination.

(i.) (Subject 2*a*.) Work in Subject 2*a* may not be sent up.

(ii.) (Subject 2*b*.) When larger and more important than examination work, well executed work in Subject 2*b* may be sent up.

(iii.) (Subjects 4*a* and 4*b*.) Works in these subjects may not be sent up.

(iv.) (Subjects 5*a* and 5*b*.) Works in these subjects may be sent up when they are more important and more finished than the work required for the personal examinations in the advanced stages of the same subjects.

(v.) (Subjects 6*a* and 6*b* from flat examples.) Works in these subjects may not be sent up.

(vi.) (Subject 7.) Work in this subject may not be sent up.

(vii.) (Subjects 8*a*, $8b^1$, and $8b^2$, and 14*a*.) Works in these subjects may only be sent up when more completely carried out (or finished) than they can be at the personal examination.

(viii.) (Subject 9.) It should be stated upon each Drawing whether it is copied from the Flat, from the Round, or is the Student's own setting of the Anatomy within an outline of a Figure.

(ix.) (Subjects 13*a* and 13*b*.) Works in these subjects may not be submitted unless well finished and from specially good examples.

(*c.*) Studies of buildings, of objects in public and private collections, landscape or landscape details, may be submitted even if executed away from the School, provided it be certified that they have been executed entirely under the supervision of the Master.

(*d.*) Drawings or paintings from flat examples or casts in relief, of the same size as the originals, may not be submitted for examination; nor may works in the modelling stages which are of the same size as the examples from which they are copied, except models from life, or flowers or foliage from nature. Drawings from the life may be submitted although executed in a short time.

Works glazed or in frames may not be submitted.

(*e.*) Only ONE satisfactory specimen of modelling may be submitted from each Student attending a modelling class. This work must be more complete than work done at personal examinations in modelling. The mouldings about decorative panels, friezes, and such like (Subjects 18, 20, 23*e*, 23*f*, *&c.*) must be always given when such works are

submitted. No copies from the Cast except careful work from the antique, or important pieces of ornament, nor fragments should be sent up. Modelled work in Subjects 18*a*, 18*d*, 18*e*, 19*g*, should not be sent up.

No cast submitted for examination may be coloured or bronzed. If necessary casts may be coated with a preparation of wax and turpentine without colour. No models in terra-cotta, clay, or kindred heavy material may be submitted.

Certificate works.

(*f*.) Works submitted for certificates by students of Schools of Art and Art Classes must be forwarded with the School or Class works of the session, and be duly entered on the Supplementary Fly-leaf to Form 528.

(*g*.) Only one certificate work in each subject, or one set of certificate works where more than one certificate work in the same subject is required, may be submitted in one year by the same student for any one certificate.

(*h*.) Every work submitted as a certificate work must be clearly marked with the title and Group of the Certificate for which it is submitted.

(*i*.) Candidates belonging to no School or Class must send their certificate works (carriage prepaid) direct to the Department of Science and Art, London, S.W., on or before the 9th of April. Each such candidate must fill up a Supplementary Fly-leaf to Form 528 in respect of the works submitted.

(*k*.) *Successes in the National Competition obtained by Students within the last ten years will, on application, be counted as equivalent to the acceptance of Certificate Works in the same subjects provided the conditions laid down in the Directory as to size, etc., for Certificate Works have been fulfilled.*

PAYMENTS ON RESULTS.

Payments on results.

31. The payments claimable, subject to the conditions of § XXXII. on account of each Student, are :—

(*a*.) 1*l*. and 10*s*. for a first class or second class respectively in the Elementary Stage of those subjects in which there is such a Stage.

(*b*.) 3*l*., 2*l*., and 1*l*. for an excellent, first class, or second class respectively in the Advanced Stage of each subject in which there is such a Stage, and in each subject in which there is no Elementary or Adanced Stage.

(*c*.) 6*l*. and 3*l*. for a first or second class respectively in Honours.

(*d*.) 3*l*., or a sum not exceeding 3*l*., for the works (*see* par. 30 (*b*, *c*, *d*, and *e*)), executed during the previous year in a School of Art or Art Class during its recognised meetings.

Restrictions on payments and previous success.

32. No payment is made under the preceding heads (*a*), (*b*), or (*c*) on account of a student who has been previously successful in a higher Stage of the same subject, or of a corresponding subject in former schemes of examination. If the student has been previously successful in the same Stage of the same subject, or in a corresponding subject, the payment on his account will be reduced by the payment which would be claimable on such previous success; but when such previous success has been obtained in a school or class under the sameLocal Committee, and has not been paid upon, the Department may allow the full claim.

When students sit at the same Annual Examination (*see* par. 18, p. 69) in both stages (Elementary and Advanced) of Freehand Drawing of Ornament in Outline, Model Drawing, and Drawing in Light and Shade from a Cast, *and in the Elementary or Advanced Stage and Honours of Modelling Design*, payment for one Stage only will be allowed on account of their successes ; and in

all such cases credit will be given for the higher success obtained. Besides payments for successes in the Elementary Stage, payments may also be made on account of the same student in any one year, for not more than three other successes whether in Advanced Stage, Honours, or in subjects having no Stages.

33. In addition to the foregoing a School of Art can claim :—

Free students and Local Scholars, payments for.

(*a.*) 3*l.* for a Student obtaining a Free Studentship or Local Scholarship (*see* pars. *45* and *46*).

Payments for Art Pupil teachers.

(*b.*) *A sum not exceeding* 15*l.* for an Art Pupil-teacher in a School of Art in which *at least* 20 students of the Industrial Classes are considered by the Department to have been satisfactorily taught; and *a further sum not exceeding* 15*l.* for a second Art Pupil-teacher, in schools in which there are, *at least,* 50 or more such students.

Branch classes of Schools of Art may not claim more than one sum under this article.

Local committees should understand that the grant is to assist them in training young, deserving, and qualified students to become Teachers, and is not claimable in respect of members of the Teaching Staff.

The Local Committee must *annually* notify their appointment of an Art Pupil-teacher to the Department. The candidate appointed by the Committee must not be required to pay fees for instruction; must have passed the 2nd Grade examination in Freehand, Geometry, Model and Perspective Drawing, or have obtained corresponding or higher qualifications at the Art examinations of the Department. The Department will consider proposals to make appointments outside this rule. The Art Pupil Teacher *during the year of his appointment* must submit works for examination, *or must sit for examination in stages other than those in which he has previously obtained success.* As a rule no person over 25 years of age may be appointed Art Pupil-teacher, the appointment must be made from year to year and no prolonged tenure of it should be offered to a candidate. In no circumstances may the same person be continued in his appointment as Art Pupil Teacher for more than five years.

An Art Pupil-teachership cannot be held by a Local Scholar. (*See* pars. 46 and 48.)

The claim to a *full* grant under this article must be supported in each case by the Art Pupil-teacher's receipt, for the amount paid to him *by the Local Committee* in respect of his services for the session of 12 months prior to the May examination; the results of which show the fulfilment or otherwise of the conditions on which the Department makes the grant for a Pupil-teacher.

In the case of Art Pupil-teachers engaged by School Boards who manage Schools of Art, the Department will make the grant to the Board under the usual conditions upon the receipt of a certificate signed by the Secretary of the Board and by the Art Pupil-teachers stating the salary they have received during the year.

Students who pass the examinations, or who send a satisfactory year's work, are considered to have been satisfactorily taught.

Payments for National Scholars.

(*c.*) 5*l.* for every student taught in the School or class who obtains a Royal Exhibition or a National Scholarship, or is admitted as a Student in Training to the National Art Training School (*see* pars. 46 and 60).

REWARDS TO STUDENTS.

Certificates.

34. A candidate who obtains an Excellent, or a 1st or 2nd Class in any subject of the Examinations receives a card or certificate recording his success.

Prizes.

35. A small number of Queen's prizes are given to those students who do best in the Examinations in the subjects stated in par. 18

on p. 69, and par. 27, p. 70, provided that they are registered students in a School under the Department, and have received at least 20 lessons from a qualified teacher within the two preceding years in the subject in which the prize is claimed.

36. Medals and books are awarded for *the best of the* works selected for the National Competition, *see* par. 28, p. 71. National Competition, medals and prizes in.

37. About 12 gold, 60 silver, and 100 bronze medals are awarded in the National Competition.

The gold medals are usually given in the following subjects:—

(*a.*) One for a drawing from the nude living model, without a background. The drawing must not be less than 24 inches high, on an imperial sheet of paper. (Subject $8c^2$.)

(*b.*) One for a similar drawing from a single antique statue. (Subject $8b^2$.)

(*c.*) One for a figure modelled and cast in plaster, to be about 30 inches high, from a full size single antique statue. (Subject 19*b*.)

(*d.*) One for a drawn or painted study, about 30 inches high, of drapery arranged on a living model, statue, or lay figure.

(*e.*) One for a painting of head or nude figure from nature, which must fairly fill a sheet, canvas, or panel 30 inches by 24 inches. (Subjects 17*b* and 17*c*.)

(*f.*) One for a painting in monochrome, about 30 inches high, from a single antique statue. (Subject 16*a*.)

(*g.*) Five for designs in Subjects 23*b*, 23*c*, 23*d*, 23*e*, 23*f*; and

(*h.*) One for a work not included in any of the foregoing subjects. [*This medal will be given by preference for a modelled head or figure in relief suitable for a medal or medallion.*]

No Student will be eligible to receive a gold medal unless he has obtained at the personal examinations held in the May of some previous year a 1st Class in the Advanced Stage of the same (or analogous) subject as that of his work entered for National Competition. Corresponding success at the 3rd Grade Examinations, which were held before the adoption of the Advanced Stage, will be counted in lieu of success in the Advanced Stage.

The silver and bronze medals are usually awarded in the foregoing and other subjects.

38. The number of medals and prizes is increased or decreased according to the merit of the works sent for examination. Candidates not eligible for prizes.

39. The following are not eligible for medals or prizes:—

(*a.*) a student who has previously received a medal or prize for the same, or a higher success, in the same subject, except as provided in par. *43*;

A certificate recording his success is given to a Student who is precluded by this rule from receiving a gold medal.

(*b.*) a teacher earning, or who has earned, payments on the results of instruction under the Department;

(*c.*) a person who is or has been a Student in Training, or National Scholar; or who is a Free Student at the National Art Training School.

40. The prizes must be claimed on Form No. 571D.

41. In large towns the local committees may be empowered to make their own arrangements for obtaining the prizes if, when sending in the claim for them (Form No. 571D), they intimate in the special certificate thereon their desire to adopt this course. The Department will then pay to the local committee the value attaching to each prize gained, and furnish one prize label for each class of book prize (Queen's or National Competition) obtained by a student; and the committee must undertake to procure books, &c. for their students to the value of each prize, as stated on p. 2 of Form No. 571D.

The Department cannot undertake to examine specially for local prizes. Where it is desired to give such prizes according to the judgment of the Department's Examiners, the local prize scheme should be so arranged as to adjust itself to their usual awards.

Restrictions on award of medals and prizes.

42. Students who obtain more than one medal of the same class in the same year, or in succeeding years, receive books, &c. instead of a second medal of the same class.

43. The award of a Gold, Silver, or Bronze medal or a book prize may be made to a student once in the National Competition in each of the Subjects 23*a*, 23*b*, 23*c*, 23*d*, 23*e*, 23*f*.

44. Students who gain medals or prizes for works may be required to pass an examination in the subject for which they have been awarded.

Free Studentships in School of Art.

45. A FREE STUDENTSHIP is granted to any student in a School of Art under the Department who, being a draughtsman, designer, modeller, or handicraftsman, has (1) gained a first class in the *immediately preceding personal* Art Examinations in the Advanced Stage or a first class in subjects not divided into stages, and on account of whose works a payment of at least 2*l.* has been awarded at the preceding annual examination (2) attended the School of Art for two consecutive years, (3) is prepared to attend regularly for the year following the date of his appointment, and (4) is recommended by the local committee of the school, who undertake to admit him to the school without payment of fees for that year. The Department may, however, exceptionally award free studentships to other deserving students recommended by a local committee.

Local Scholarships, Royal Exhibitions, and National Scholarships.

46. LOCAL SCHOLARSHIPS, ROYAL EXHIBITIONS, AND NATIONAL SCHOLARSHIPS.—The following are open to British subjects, and are awarded in Competition as stated below:—

SIXTY LOCAL SCHOLARSHIPS, 20 open each year, at Local Schools of Art under the Department.

THIRTY ROYAL EXHIBITIONS, 10 open each year, to the National Art Training School or the Metropolitan School of Art, Dublin.

SIXTEEN NATIONAL SCHOLARSHIPS, eight open each year, to the National Art Training School and South Kensington Museum.

47. No candidate can obtain both a Royal Exhibition and a National Scholarship; nor can he hold a Local Scholarship with either. But the past or present holder of a Local Scholarship may compete for a Royal Exhibition or a National Scholarship, and the Local Scholarship will determine as soon as the holder enters on the Royal Exhibition or National Scholarship.

48. A LOCAL SCHOLARSHIP is tenable for three years, with a maintenance allowance of 20*l.* a year, at any School of Art under the Department which is open at least three days and five nights a week, and which will remit the fees for instruction of the holder. The Scholar must attend a School of Art during at least 40 weeks in the year for 30 hours each week, of which 18 hours at least must be in the day. The Scholarship commences on the date at which the School, where the Scholarship is tenable, re-opens after the Summer vacation in each year. The maintenance allowance is paid quarterly, on the receipt of a certificate from the Master and Secretary of the School of Art that the Scholar has attended regularly and pursued his studies satisfactorily.

49. A ROYAL EXHIBITION is tenable for three years, and entitles the holder to free admission to the National Art Training School at South Kensington or the Metropolitan School of Art, Dublin, for the session of about 42 weeks each year, and during that time to a maintenance allowance of 25*s.* a week and third-class railway fare for one journey to and fro, each session, between the home of the Scholar and London or Dublin.

50. The Royal Exhibitions are held on the condition that the Exhibitioner attends the course of instruction laid down for him regularly, complies with the rules laid down for his guidance, and makes satisfactory progress.

51. The Local Scholarships and Royal Exhibitions are only open to students on account of whose instruction payments on results can be made, *see* § XXXII. The Competitor for a Local Scholarship must be under *22* years of age, and the Competitor for a Royal Exhibition under *25* years of age, on the 1st May of the year in which he competes.

52. A candidate who is eligible in respect of age may compete for both a Royal Exhibition and a Local Scholarship, and, if successful for both, will be allowed to choose which he or she will hold.

53. Art Teachers in Training and National Scholars, past or present, are not eligible for Local Scholarships or Royal Exhibitions. A Student holding an Art Pupil-teachership cannot also hold a Local Scholarship. Competitors for Local Scholarships or Royal Exhibitions must send in Form No. 1181 before the 15th April, and Form No. 1,202 before the 10th June.

54. The Competition for the Local Scholarships and the Royal Exhibitions is determined on the results of the May personal Examinations in Art of the year, and previous successes are not counted.

55. Candidates may sit for examination in any or all of the specified subjects, except when two examinations are held on the same evening (see paragraph 18). Candidates who may have previously passed examinations in any of the specified subjects, or in corresponding subjects, may sit again for the purpose of earning marks in the Competition.

56. The subjects of Examination with the maximum number of marks obtainable towards these Scholarships and Exhibitions are :—

Freehand Drawing of Ornament (Advanced Stage)	100 each.
Model Drawing (Advanced Stage)	
Drawing in Light and Shade from a Cast (Advanced Stage)	
Perspective (Elementary Stage)	
Anatomy	
Principles of Ornament (Advanced Stage)	140 „
Architecture	
Painting in Monochrome	180 „
Painting Still Life	
Historic Ornament	
Drawing the Antique from Memory	
Drawing from the Antique	200 „
Drawing from Life	
Design—Subject 23c (Advanced Stage)*	
Architectural Design	
Design—Subject 23d (Honours)*	
Modelling from Life	
Modelling from the Antique	
Modelling Design (Advanced Stage)*	
Modelling Design (Honours)*	

But the number of marks gained by the Candidate in each subject is diminished by the number required to pass in that subject. The remainder are then added together to determine the Candidate's position.

57. The National Scholarship is tenable for two years, and in special cases may be renewed for a third. The Scholar receives a maintenance allowance at the rate of 25*s.* a week for the Session of about 42 weeks each year, and third-class railway fare for one journey to and fro, each session, between his home and the National Art Training School, London.

58. Only Students of Schools of Art who are engaged in trades which depend upon decorative Art are eligible to compete for National Scholarships. The selection will be made by giving due weight to the nature and requirements of the trades represented by the Candidates, to the evidence they give of special aptitude for design, and to the progress they have made at the Schools at which they have studied as shown by the works they submit and the Examinations they have passed. Applications must be made on Form No. 488, accompanied by drawings, designs, and other evidence of the Candidate's ability before the 20th July.

59. The National Scholar will be required to prosecute a course of studies laid down for him by the Director for Art in the Museum

* Candidates cannot sit for both the Advanced Stage and Honours in these subjects.

and National Art Training School, and will only hold his Scholarship so long as he pursues his studies diligently, and shows satisfactory progress.

60. Studentships in Training at the National Art Training School are open to competition among students of Schools of Art who hold the Art Master's Certificate, Group I. *See* par. 6, p. 80.

Princess of Wales' Scholarships.

61. "PRINCESS OF WALES'" SCHOLARSHIPS.—Two scholarships, of about the value of 25*l.* and 11*l.* respectively, are open to competition each year and are awarded to the two female students of School of Art who take the highest prizes (not Honorary Awards) of the year in the National Competition. These Scholarships date from the 1st October in each year, and are tenable for one year in the School of Art only where they have been gained. The scholarships are not awarded to the same persons for more than three years in succession. Students in Training, National Scholars and Free Students of the National Art Training School, past or present, are not eligible for these Scholarships.

Each "Princess of Wales' Scholar" is required to present half-yearly reports of the course of study she has pursued at her School of Art during her tenure of the scholarship. These reports must be sent through the Secretary of the School of Art in which the scholar is studying, on the 31st of March and 30th of September. A moiety of the sum awarded will be paid on the receipt of each report if it be satisfactory.

GRANTS FOR TRAVELLING TO MASTERS AND STUDENTS.

Art Masters' visits to London, Foreign Towns, &c.

62. Grants will be made to enable a limited number of masters and students of SCHOOLS OF ART to see the works in the National Competition exhibited at South Kensington; to visit and study in the South Kensington Museum, the National Art Training School, and other Institutions; and, in special cases, Foreign Towns, Schools, and Galleries, to study and make sketches of buildings and of objects in museums; or to study in any approved centre of Art instruction. They may be required to do special work for the Department.

Application must be made on Form No. 1178.

Travelling expenses.

63. The travelling expenses which may be allowed to Teachers and Students are third class railway fares and not more than 7*s.* 6*d.* a night while required to be absent from home; but no cab or omnibus fares unless they are travelling in the service of the Department, when they are allowed 2nd class railway fares and 10*s.* personal allowance per night while required to be absent from home.

Vacation courses of Art instruction.

64. Short courses of instruction in Modelling, Design, and Drawing from the Life for a limited number of Teachers and Advanced Students are given in the National Art Training School and South Kensington Museum. Application for admission to these courses must be made on Form No. 234*a* before the 30th of June. The candidates selected will receive third class railway fare for one journey to and fro between their homes and the National Art Training School, and 3*l.* towards their expenses while attending the courses.

NATIONAL ART TRAINING SCHOOL, LONDON, S.W.

Purpose of National Art Training School.

1. THE NATIONAL ART TRAINING SCHOOL is established for the purpose of training Art Masters and Mistresses for the United Kingdom, and for the instruction of students in Drawing, Painting, Modelling, and Designing, for Architecture, Manufactures, and Decoration.

Admission to School.

2. Free admission to the courses of Instruction is granted to Students in Training, National Scholars, and Free Students (*see* pars. 6 to 14). Admission is also granted to the general public on payment of fees (*see* par. 17).

Hours of study.

3. The School is open for study every week-day, except Saturday. Day Classes from 9 a.m. to 4 p.m., with an interval of half an hour for lunch; evening classes from 7 p.m. to 9 p.m. for male students, and from 6.30 to 8.30 for female students, except during the months of May, June, and July, when the evening classes meet from 6 to 8 p.m. Life classes and class lectures commence at 10 a.m. and close at 3.30. p.m.

Terms.

4. The Annual Session consists of two terms, each lasting five months, and commencing on the 1st Wednesday of October and the 1st of March, and ending on the last day of February and the last Friday of July respectively.

Vacations.

5. Vacations for the session 1894–1895 :—

The School re-opens after the Long Vacation, 1894, on Wednesday, 3rd October. Christmas, the School closes 3 p.m., Friday, 21st December 1894, and re-opens 9 a.m., Monday, 7th January 1895. Easter, the School closes Thursday, 11th April, and re-opens Wednesday, 17th April. Whitsuntide, the School closes Friday, 31st May, and re-opens, Wednesday, 12th June. Long Vacation, 1895, the School closes Friday, 26th July, and re-opens Wednesday, 2nd October. Christmas, the school closes 3 p.m., Monday, 23rd December 1895, and re-opens 9 a.m., Tuesday, 7th January 1896.

FREE STUDENTSHIPS, NATIONAL SCHOLARSHIPS, &c.

Studentships in training.

6. STUDENTSHIPS IN TRAINING AT THE NATIONAL ART TRAINING SCHOOL.—Students of Schools of Art (whether men or women) who have taken the Art Master's Certificate, of the 1st Group, and are preparing to become Teachers, are eligible to compete for admission to the training class of the National Art Training School, with a maintenance allowance at rates of from 12*s.* 6*d.* *to* 43*s.* 6*d.* a week for the session of about 42 weeks each year and 3rd class railway fare for one journey to and fro, each session, between the home of the student and the National Art Training School. They must attend regularly all the meetings of the school. They may be required to perform certain duties as teachers, and must engage to accept the situations to which they may be recommended. They are not at liberty to accept situations without first obtaining the consent of the Principal. Applicants for admission must fill up and send in Form No. 488 before the 15th January or the 20th July. Students who have been on the list of paid Students in Training or National Scholars, and who retire with credit, may continue to study in the School as Free Students for one year, and this Free Studentship may be renewed on the conditions laid down in paragraph 27 (*d*) of this Prospectus.

Allowances to students in training.

7. Allowances to Students in Training are renewable from Term to Term; but no male Student may remain on the list of paid Students for more than four years, and no female Student for more than two years, without the sanction of my Lords on a special recommendation; and no Student may remain even that time unless he or she does well from Term to Term.

Royal Exhibitions and National Scholarships.

8. ROYAL EXHIBITIONS AND NATIONAL SCHOLARSHIPS.—*See* pars. 46, &c., p. 76.

Grants for students' travelling expenses.

9. Students in Training and National Scholars may, in special cases, receive grants in aid of their travelling expenses in visiting Foreign Schools and Galleries. They may be required to do special work for the Department.

10. The Department reserves the right to retain works done in the School by Students in Training or National Scholars.

Subject to disallowance.

11. Should the conduct or progress of National Scholars or Students in Training be unsatisfactory their allowances may be reduced or wholly withdrawn.

12. ADMISSION OF STUDENTS OF THE ROYAL ACADEMY TO THE NATIONAL ART TRAINING SCHOOL.—Students of the Royal Academy who desire to become Teachers, and who have attended the Life Class or Upper Division of the Architectural Class there for six months during the last three years, or persons who have been students at the Royal Academy within the last three years, are qualified for admission to the Training School, and to receive an allowance of 15*s.* per week for the 42 weeks of the session. This allowance will be withdrawn if the student does not succeed in obtaining the Art Class Teacher's Certificate, and completing the examination for the Art Master's Certificate, Group I., within the period of three terms. Admission of students of Royal Academy.

STUDENTS OF THE ROYAL SCHOOL OF ART NEEDLEWORK who desire to avail themselves of the instruction in the National Art Training School are admitted on payment of a fee of 1*l.* per term of five months for one day per week. Of students of the Royal School of Art needlework.

STUDENTS OF THE SCHOOL OF WOOD CARVING who wish to attend the lectures on Design are admitted without entrance fee and at half the fee for the course of lectures. Of students of the School of Wood Carving.

13. FREE STUDENTSHIPS AT THE NATIONAL ART TRAINING SCHOOL.—Industrial Students in a School of Art who have paid fees for one year, and are prepared to become Teachers, Manufacturers' Draughtsmen, Designers, or Art workmen, are entitled, after taking the Art Class Teacher's Certificate, and within 12 months from the date when they became qualified to apply for the certificate, to apply through the Secretary of their Schools for free admission for *two consecutive terms* to the National Art Training School. This free admission may be renewed for *the two terms next following* those for which it was first granted, provided that the Student obtains the Art Master's Certificate, Group I., or an Honorary award in the National Competition, or a first class in the advanced stage, in two or more subjects of the May Examinations, of which one must be the Principles of Ornament, held during the *period for which the grant of free admission to the National Art Training School is made to him.* Other free studentships.

Free admission for short periods may be exceptionally granted to specially qualified persons, and to Teachers of Schools of Art who are specially recommended by their Committees.

14. Three free studentships for Modellers, tenable for one year, are open to competition by Students of Art Schools who execute successfully a model of a head from the antique. The competition for these Studentships takes place on the second Wednesday in July and following days at the School. They may be renewed for a second year on taking the Art Class Teacher's Certificate or an Honorary award in the National Competition. Free studentships for modellers. Renewal.

AWARDS and GRANTS to NON-FEE-PAYING STUDENTS.

15. THREE TRAVELLING SCHOLARSHIPS of 50*l.* yearly each are offered for competition among the National Scholars, Students in Training, and Free Students. A travelling Scholarship cannot be held a second time by the same Student. Travelling scholarships.

16. HONORARY AWARDS only are made to Free Students, National Scholars, and Students in Training, in respect of successes gained by them at the Examinations, and in the National Competition. Honorary awards.

DIVISION FOR STUDENTS PAYING FEES.

[FEES MUST BE PAID BEFORE ADMISSION TO ANY OF THESE CLASSES CAN BE GRANTED.]

17. The scale of fees for the admission of the general public to the Schools is as follows:— Admission on payment of fees.

	£	*s.*	*d.*		
The payment of	5	0	0	per term entitles a Candidate to admission to the School for 5 months for both day and evening classes.	In addition to these fees an entrance fee of 10*s.* is chargeable to a Student on first joining the day classes, or on rejoining them after an absence of a year; but it is not chargeable to Free-students, or to Students who, after admission to the School as Free-students or Governesses, may change their position and become Students paying these fees, except after a year's absence.
				DAY CLASSES.	
The payment of	1	1	0	per term entitles a Candidate to admission to a special Architectural Class held on Tuesdays.	
The payment of	1	1	0	per term entitles a Candidate to admission to a Special Designing Class on either Mondays or Tuesdays. (The fee is 2*l.* 2*s.* for both days.)	
The payment of	1	0	0	per month entitles Governesses in private schools or families to attend day classes for three months in any one calendar year,	

EVENING CLASSES.

	£	s.	d.	
The payment of	2	0	0	per term of five months entitles a Candidate to admission every evening, except Saturdays. (For Male Students.)
The payment of	1	0	0	per term of five months entitles a Candidate to admission on Tuesdays, Thursdays, and Fridays (for female Students) from 6.30 to 8.30 p.m., or from 6 to 8 p.m.
The payment of	0	5	0	per term entitles Schoolmasters, Schoolmistresses, and Pupil-teachers of Public Elementary Schools to attend on any two evenings in each week, on one of which instruction in Blackboard drawing and demonstration will be compulsory.

AN EVENING ARTIZAN CLASS

is held in the Elementary Room, for the Elementary Stages of Freehand Drawing, Model Drawing, Drawing in Light and Shade from a Cast and Section I., Science Subject I.

The payment of	0	15	0	per term or 5s. per month entitles a Candidate to admission for five evenings weekly.
The payment of	0	10	0	per term or 3s. per month entitles a Candidate to admission for three evenings weekly.

Students of this Class who have paid fees in it for two consecutive terms, and have passed in all subjects of the 2nd Grade Certificate or Elementary Drawing Certificate (First Class), and Schoolmasters and Mistresses who hold the Elementary School Teacher's ("D") Certificate or Elementary Drawing Certificate (First Class), may also work in the general class-rooms at the same fees as an evening artizan student.

Students desiring to continue their attendance at the Schools for a short period beyond that covered by the fees they have paid, may be allowed to do so upon the recommendation of the Principal, coupled with the payment of monthly rates according to the usual scale.

Pass 2nd Grade Examination. Freehand required.

18. Students who have passed the 2nd Grade examination in Freehand Drawing or have obtained corresponding or higher successes in a similar subject at the Art examinations of the Department may join the School at any time during the session, on payment of fees for not less than five months. At the end of the five months, if there be less than five months between that time and the end of the session in July, the student may remain until the end of the session on payment of a proportional fee for each week unexpired up to the last Friday of July. The months of August and September, being the vacation, are not counted as part of the five months paid for.

Examinations for admission.

19. Students who have not passed an Examination in Freehand Drawing cannot be admitted until they have passed the admission Examination. Examinations for admission are held weekly at the commencement of each term, and at frequent intervals throughout the year at the School, on Tuesdays, at 11.45 a.m. and 6.45 p.m., except in the months of May, June, and July, when the evening examination takes place at 5.45 p.m. The examination fees are 2*s*. 6*d*. for day Students, and 6*d*. for evening Students, to be paid at the time of examination. Candidates should bring their own lead pencils and india-rubber. Unsuccessful candidates cannot be re-examined until after a month's interval. Students who are engaged in the Building Trades may, on producing a certificate to that effect from their employers, join the Architectural Class without passing this admission examination. *Success at the admission examination does not count towards any certificate.*

Dates of Entrance Examinations.

Entrance Examinations during 1894–95 will be held as under:—

1894.	
May 29th.	October 2nd, 9th, 16th, 23rd, and 30th.
June 12th and 26th.	November 6th and 27th.
July 24th.	December 18th.
1895.	
January 8th, 15th, and 29th.	July 23rd.
February 12th and 26th.	September 24th.
March 5th, 12th, 19th, and 26th.	October 8th, 15th, 22nd, and 29th.
April 9th and 30th.	November 5th and 26th.
May 28th.	December 17th.
June 18th and 25th.	

Register of attendance.

20. A REGISTER of the Students' attendance is kept, and may be consulted by parents and guardians.

21. Students, unless they obtain leave of absence, must remain in the Schools until 3.30 p.m., except during the half-hour for lunch, viz., from 1 to 1.30 for male Students, and from 12.30 to 1 for female Students.

22. THE COURSE OF INSTRUCTION for Students who are not in receipt of allowances, nor working for Art Certificates applies to Ornament

and the Figure with a view to their ultimate use in design and composition, and includes the study of plants and flowers, the painting of Still-life, and the drawing and painting of Ornament, and of the Figure; and all Students who have not done so, are expected to pass the Department's Examination in the Principles of Ornament as soon as possible after entering the School.

23. In following out the Courses of Instruction, Students are required to pass, with the approval of the Principal, in the following subjects :—

I. Course for Students wishing to study Landscape, Still-life, and Flower Painting :

1. Elementary.—Preparatory to any study in this Course :—
   Subject 2*b*. Freehand drawing in outline from the flat if necessary (from Dyce and Jacobsthal).
   „ 3*b*. Freehand drawing in outline of ornament from the round.
   „ 11*a*. Painting in Sepia from the flat.
2. Preparatory to Painting from Nature in Oil or Water-colour :—
   Subject 10*a*. Outlining Foliage from Nature.
   Subjects 5*a* & 5*b*. Shading in Chalk from Models, Casts of Ornament, Fruit, &c.
   Subject 12*a*. Painting in Sepia, or Monochrome, or Tempera from Casts of Ornament.
   „ 13*a*. Painting Flowers, &c., from the flat.
3. Advanced :—
   Subjects 15*a* & 15*b*. Painting Flowers, groups of Still-life, &c., from Nature in Water-colour or Oil.
   Subject 13*b*. Landscapes from Copies.
   Students in this Course should attend the class lectures on Model-drawing and Plant-form.

II. Course for Students wishing to study the Figure :—

1. Elementary.—Preparatory to any study in this Course :—
   Subject 2*b*. Freehand drawing in Outline from the flat (if necessary).
   „ 8*a*. Outline drawing of details of the Face from the round.
   „ 8*a*. Outline drawing of the Head, Hands, and Feet, and whole Figure from the round.
   Subjects 5*a* & 5*b*. Shading in Chalk from Models, and Casts of Ornament.
   Before being admitted to the next Preparatory Course, Students must pass through the Model-drawing and Perspective class.
2. Preparatory to drawing from the Life :—
   Subject 8*b*1. Shading in Chalk from Heads, Hands, and Feet from the Cast.
   „ 8*b*2. Shading the whole Figure from the Antique.
   „ 9*a*. Outlines of the Skeleton, and Anatomical Figure, with the names of the Bones and Muscles.
   Students must attend the class lectures on Anatomy and pass the examination on the course.
3. Preparatory to Painting from the Life, in Oil or Water-colour :—
   Add to the above,
   Subjects 12*a* & 16*a*. Sepia, Tempera, or Monochrome painting of Ornament and the Figure from the Cast.
4. Advanced :—
   Subjects 8*c*. & 8*d*. Shading in Chalk from the living Model, nude or draped.
   „ 17*b*. Painting from the living Model, in Oil or Water-colour.
   „ 8*d* or 14*c*. Studies of Drapery drawn or painted.
   23*d*. Figure composition.

III. Course of design. (This will also be the course for those Students in Training who are working for the Art Master's Certificate, Group II.).

Students in design, unless they have taken or are working for the Art Master's Certificate, Group I., must first follow the Elementary Course in No. I.

The advanced class is under the direction of Mr. Stannus. The Students must attend his lectures, and Mr. Hagreen's Course of Lectures on Elementary Architecture.

The course will consist—

1. Of Outline Drawing and Monochrome colouring from Jacobsthal, Meurer, Teirich, Gruner, and other works, which must be used not only as a means of studying drawing, but as a definite course of design.

2. Subject 11*b*. Painting Ornament from flat examples in Colours.
   „ 12*a*. Painting Ornament in Monochrome from the Cast.
   „ 14*a*. Studies of Plants from Nature.

3. Designing in imitation or completion of given examples.

4. Composition. Subjects 23*b*, 23*c*, & 23*d*.

IV. Modelling.

Before entering the Modelling class, Students must pass the Elementary stages in Course II., and attend the Model-drawing and Perspective lectures.

V. Etching.

Students desirous of entering the Etching Class must give evidence that they are sufficiently advanced in drawing to profit by the instruction, and obtain permission to attend.

Class lectures.

24. Time Table of Class Lectures in the National Art Training School.

Day.	Morning.	Afternoon.	Evening.
Monday	(Advanced Stage) - Perspective (Advanced Stage) Class Lecture.	Design (Elementary)	Geometrical Drawing, Section 1, Science Subject I. A. C. Teachers.
Tuesday	Geometrical Drawing, Section 1, Science Subject I. Anatomy, Class Lecture Architecture, Class Lecture.	Design (Advanced) -	Perspective (Elementary Stage.) A. C. Teachers.
Wednesday	Perspective (Advanced Stage) Class Lecture.	Perspective (Advanced Stage).	Perspective (Advanced Stage). A. C. Teachers.
Thursday	Model Drawing Lecture, Advanced Stage.	Plant Drawing and Painting relating to design.	A. C. Teachers and Blackboard Practice.
Friday	Details of Human Figure.	Anatomy, Class Lecture, Analysis of Ornament (Free-hand).	A. C. Teachers.

Lectures and Demonstrations.

25. Courses of Lectures and Demonstrations on Ornamental Art and on Anatomy as applicable to the Arts may be given each year as announced. The Anatomy Course may be attended by ladies. Other Lectures may be delivered occasionally. Students may apply for free admission to the Lectures. The Fees are for a single lecture 1*s*., for a course at the rate of 6*d*. per Lecture.

Prizes to Fee paying Students.

Prizes.

26. For prizes open to fee-paying students, and for Medals, *see* Art, pars. 35, 36, and 37 on pp. 74 and 75.

Privileges granted to Fee-paying Students of the National Art Training School.

27. Students of the National Art Training School who have paid fees for two consecutive terms in the School, and who are preparing to become teachers, manufacturers' draughtsmen, designers, or Art workmen, are entitled— Privileges granted to students.

(*a.*) To attend their class for one year, on payment of half the usual fee, on passing in the Elementary Stage of Science Subject I., and obtaining a 1st class in the examinations (Elementary Stage) in Freehand, Model, and Perspective Drawing.

(*b.*) To a continuance of the same privilege for the next year only, if they pass the examination (Elementary Stage) in the Principles of Ornament at the May examinations or gain a prize in the National Competition, of the year.

(*c.*) After taking the Art Class Teacher's Certificate to free admission for one year, renewable for the next year only, provided that they obtain the Art Master's Certificate, Group I., or an Honorary award in the National Competition, or a 1st class (Advanced Stage) in two or more subjects,* of which one must be the Principles of Ornament, of the May examinations of the year.

28. Students of the National Art Training School who are preparing to become manufacturers' draughtsmen, designers, or Art workmen, and who, *after having paid fees for two consecutive terms in the School*, obtain the Art Master's Certificate, Group I., or a National Scholarship (*see* par. 8 of this Prospectus), are entitled—

(*a.*) To free admission for a year, provided that, *in either case*, they pass the examination (Advanced Stage) in Principles of Ornament; and

(*b.*) To a continuance of free admission, provided that they take annually an Honorary award in the National Competition, or a 1st class (Advanced Stage) in two or more subjects* of the annual personal Examinations.

* N.B.—*The successes in respect of which free admission is continued must be different from and not lower than those previously gained by the Students concerned.*

Admission of Students to Museums and Libraries.

29. All properly qualified Students of the National Art Training School are entitled to admission to the South Kensington Museum and Libraries, either for consultation or copying, as well as to all the School Lectures of the Department.

Students in Training, National Scholars, Royal Exhibitioners and other free students recommended by the Principal may be granted the privilege of borrowing books from the Students' Lending Library at the National Art Library.

Further information may be obtained on personal application to the Registrar at the Schools, or by letter addressed to the Secretary, Department of Science and Art, London, S.W.

Form No. 1294.
Art.

PART II.

GRANTS FOR DRAWING IN ELEMENTARY DAY SCHOOLS.

Definition.

1. The term Elementary School includes (*a*) a Public Elementary School under the Education Department for England and Wales; (*b*) a Public or State-aided School under the Scotch Education Department; and (*c*) any other School, or department of a School, at which Elementary Education is the principal part of the education there given; but does not include any School or department of a School at which the ordinary payments in respect of the instruction, from each Scholar, exceed ninepence a week, or which is conducted for private profit.

2. With the exception of the grants for Pupil-teachers and Ex-Standard (*Code*) Scholars provided for in §§ 24 and 25, grants under these rules are only made on account of Scholars of Elementary Schools whose names are on the School Register and who are receiving instruction in the obligatory or standard subjects prescribed by the Minutes of the Education Department for the time being. No grants are made under these rules to Schools under the Commissioners of National Education in Ireland.

3. No grants are made for Scholars in the Standards in Elementary Schools, as defined above, under the rules for Art Classes or Art Schools.

4. The grants may be withheld, wholly or in part, for any breach of the rules, or for any error or neglect on the part of the Managers or Teachers.

5. The Department is the sole judge as respects all grants and awards.

How to obtain aid.

6. No School is placed on the list of Schools claiming grants for Drawing until an application has been addressed to the Secretary, Department of Science and Art, London, S.W., and a Form (No. 520) of preliminary statement filled up and sent to the Department by the Managers. If application for a grant is not made within six months after the date at which the teaching of Drawing is commenced, the Department may refuse to make a grant for any time previous to the receipt of the application. The application need not be renewed annually. The Managers must appoint one of their number to act as Correspondent, and give notice to the Department of any change. Members of School Boards and their Officers are Managers for the purpose of these rules. The Clerk of a School Board may act as Correspondent for all Schools under the Board.

Teachers.

7. The Drawing should be taught by a Teacher holding the Elementary School Teacher's Drawing certificate (D.), the Elementary Drawing Certificate (First Class), the 2nd Grade, or a higher, Art certificate; and if no Teacher of the

School is well qualified to give instruction in Drawing, it is most desirable that an outside Teacher, such as the Teacher of a School of Art or Art Class under the Department, should be engaged at least to assist in the instruction. But the possession of a Certificate in Drawing on the part of the Instructor will not, for the present, be insisted on as a necessary condition of the School earning the grant for Drawing. If it should at any future time be found expedient or necessary to impose the condition that the Teacher of Drawing should hold a certificate from the Department of Science and Art, Teachers of Elementary Schools who were certificated as such and engaged in teaching before the 1st of January 1893 will be exempted from its operation. That is to say, no School will be disqualified from earning a grant for Drawing on the ground that its Teacher was not certificated in Drawing if he had been certificated as an Elementary School Teacher, and teaching as such in that or any other Elementary School, before the 1st of January 1893.

Until 31st December 1896, *certificates of qualification to earn grants on the teaching of Drawing in Elementary Schools may be granted to Teachers who do not hold the Elementary Drawing Certificate, but have taught Drawing in Schools which have obtained two or more good reports since August* 1891, *provided that such Teachers satisfy the following conditions:—*

(1.) *They must have been recognised by the Education Department as Teachers of Elementary Schools for at least seven years previous to 1st September* 1891, *when Drawing was made a compulsory subject of instruction for all boys in Schools for older Scholars; and* (2) *they must present a certificate, if required by the Department, from the Managers of the Schools in which they have taught Drawing that instruction in that subject was given by them regularly throughout the period in which the Schools obtained the requisite reports.*

Requirements as to instruction in Drawing.

8. Drawing must be taught throughout the School to all Boys in Schools for older Scholars; but it is not essential that Drawing should be taught to Girls. Infant Schools, or Infant departments, or Infants in a School for older children, or Scholars in Standard I. or II. if taught in an Infant School, cannot be examined under these Rules, except that in Schools in Scotland, when the organisation of a School places in the Infant department children in the classes corresponding to Standards I. or II., they must be examined in drawing. The Time Table must provide for *at least* one hour and a half of instruction in Drawing during the week, and this instruction must be given regularly throughout the year This last requirement is imperative in all cases; and in half-time Schools the 1½ hours should be so fixed in the time-table that the half-time Scholars may receive instruction in Drawing for at least 1½ hours each fortnight.

Girls and drawing grant.

9. In order that the girls in (*a*) a Public Elementary School in England and Wales, or (*b*) a Public or State-aided School in Scotland, may earn a grant for Drawing, the Managers thereof must certify that the Time Table for Girls provides for the instruction of Girls in Cookery according to the rules of the Education Code.

Inspection.

10. The School must be open at all times to the visits and inspection of the Officers of the Department of Science and Art.

Dates of Examination.

11. The examinations are held by Inspectors appointed by the Department of Science and Art, and a room or rooms of sufficient size to hold the examination according to the regulations of the Department must be provided. As a rule the examinations of Schools under the English and Scotch Education Departments are held annually in the month next preceding that of their inspection by Her Majesty's Inspector. The examinations of other Elementary Schools are held on dates to be arranged between the Managers and the Inspectors. All changes of the month of examination must be previously approved by the Department.

Standards of examination.

12. No persons other than scholars of the School in which the examination is held may attend the examination; except as is provided in §§ 23, 24, and 28 below.

13. The Standards of examination in Drawing are as follows, and they must be taken consecutively:—

Standard I. Drawing, freehand, and with the ruler, of lines, angles, parallels, and the simplest right-lined forms, such as some of those given in Dyce's Drawing Book. (*To be drawn on slates or on paper, at the option of the Managers.*)

Standard II. The same *on paper only.*

Standard III. (*a.*) Freehand drawing of regular forms and curved figures from the flat.
(*b.*) Simple geometrical figures with rulers.

Standard IV. (*a.*) Freehand drawing from the flat.
(*b.*) Simple scales and drawing to scale.

Standard V. (*a.*) Freehand drawing from the flat.
(*b.*) Drawing from rectangular and circular models, and from easy common objects.
(*c.*) Geometrical figures with instruments and to scale.

Standard VI. (*a.*) Freehand drawing from the flat.
(*b.*) Drawing from models of regular forms and from easy common objects.
(*c.*) Plans and elevations of plane figures and rectangular solids in simple positions, with sections.*

Standard VII. (*a.*) Freehand drawing from the flat.
(*b.*) Drawing any common objects and casts of ornament in light and shade, or
(b^1.) Geometrical drawing more advanced than in V.
(*c.*) Plans and elevations of rectangular and circular solids with sections.*

N.B.—In order to interest the children it is advisable to teach them to draw as early as possible from actual objects, such as the doors and windows, furniture and apparatus of the schoolroom. It will also be found quite possible and very desirable to go beyond the foregoing standards in teaching. Thus freehand drawing of bold curves may be introduced in Standards I. and II.; and exercises may be advantageously given, in all standards, in drawing from memory.†

Special classification for Drawing.

14. The classification for instruction in Drawing need not correspond with the ordinary Standards of instruction in the School. But where Standard I. (Code) is taught in the Infant department and there is no Standard I. (Code) for older Scholars, the examination of the older Scholars in Drawing must begin with Standard II.; and where there is a Standard I. (Code) both in

* Girls are not required to take the subjects specified in Standards VI. (*c.*) and VII. (*c.*).

† An illustrated syllabus of the course of instruction in Drawing may be obtained from the Department of Science and Art, price 2*d.*, or from the Department's Agents, price 3*d.* [*See* list of publications at end of Directory.]

the Infant department and in the School for older Scholars, the examination in Drawing of Scholars promoted from Standard I. (Code) in the Infant department to Standard II. (Code) in the School or department for older Scholars must begin with Standard II. in Drawing, which is the same as Standard I. except that the Drawing is on paper and not on slates. All Scholars must be presented for examination in the Standards in which they have been taught Drawing, and in ordinary circumstances Scholars should be advanced not less than one Standard a year.

Drawing Schedule.

15. The Managers must keep suitable registers of the attendance of the Scholars, and they must furnish the Inspector, when he examines the School in Drawing, with a Schedule in Form No. 1294D, giving the names of all Scholars on the School register, arranged in the Standards in which they are to be examined in Drawing. The Schedule must be certified by two of the Managers, or in a Board School, by the Clerk, of the School Board or two Managers appointed under section 15 of the Education Act, 1870, or under section 22 of the Scotch Education Act, 1872. Half-time Scholars must be indicated by the letters H.T. after their names. The letter L should be placed against the names of Scholars, if any, who have been admitted during the last six months preceding the examination. The Managers must keep a copy of this Schedule for the Inspector to refer to. The names of all absentees must be noted in the Schedule, with the causes of their absence certified by the principal Teacher or Teachers or by the attendance officer. The Inspector will report if any Scholars are absent without reasonable excuse. He will not inquire into the reasons for the classification of particular children if he is satisfied that the School as a whole is making fair progress in Drawing. But if he has reason to suppose that there has been any abuse of the freedom given by the present regulations,—if, for instance, low classification is attributable to neglect of the Scholars, or if the classification is such as to interfere seriously with the efficiency of the arrangements for Drawing in the School,—it will be his duty to report the matter to the Department. If the instructions with regard to the preparation of a Schedule have not been complied with the Inspector may refuse to hold an Examination and the School will lose its grant for Drawing.

Results.

16. In deciding whether the instruction in Drawing shall be marked as "Excellent," "Good," "Fair," or "Failure," the method and time of instruction, the number of half-time Scholars, the provision of examples, the presence of sickness in the district during the past year, or at the date of the Inspector's visit, irregularity of attendance from causes beyond the control of the Managers, or any other circumstances for which the Managers are not responsible, and which may affect prejudicially the progress of the Scholars, will be considered, as well as the results of the Examination.

Requirements as to Standard.

17. In Schools in which Drawing is taken for the first time, the instruction need not, for the first year, extend beyond Standard IV. for Drawing (§ 13), or beyond Standard III. in small Schools with an average attendance, of boys and girls together, not exceeding 60.

But no School will be required to take a Standard in Drawing higher, or lower, than the Standards of Elementary instruction taught in it under the Education Code, and in small Schools the instruction may be grouped for convenience of teaching so long as the various subjects are fairly taught and none are skipped.

Paper for examinations.

18. For the examination the Managers must provide a sufficient quantity of common white cartridge paper cut in sheets of about the size of imperial octavo, or about 11 ins. by 7¼ ins. For Drawing from the Cast the same or somewhat larger paper, but not exceeding 15 in. by 11 in., either white or tinted, may be used, and for some problems in Drawing to Scale in Standard IV. there must be a supply of squared paper with lines about ⅛ of an inch apart. Squared paper may not be used for other drawings; nor may squared slates, or slates ruled with indented lines, be used by Scholars in Standard I.

Amount of Grant.

19. Subject to compliance with the foregoing conditions, a grant is made of 1*s.*, 1*s.* 6*d.*, or 2*s.* for each Scholar, or, where the girls are not examined in Drawing, for each boy in average attendance, if the award be "Fair," "Good," or "Excellent," respectively. The "average attendance" during any period is the number found by dividing the total number of "attendances" by the number of times on which the School met during such period. In Schools under the English and Scotch Education Departments the attendances must be taken from the ordinary Register of the School: other Schools must keep an Attendance Register or some similar form. Grants on average attendance are only made on account of Scholars whose names are on the Register of the Elementary School. "Infants" may not be included in the "average attendance" under this regulation. In Schools in Scotland the grants are paid on the average attendance of children over 7 years of age.

"Average attendance."

20. The awards to Schools under inspection are reported to the English and Scotch Education Departments.

Grants paid to end of School year.

21. The grants are in all cases paid up to the end of the School year. The School year of Schools under the inspection of the Education Departments is the year ending with the last day of the month preceding that fixed for H.M. Inspector's annual visit. The School year of Schools not under the inspection of the Education Departments ends with the month preceding that approved by the Department of Science and Art for the examination in Drawing by the Inspector. If the instruction for which the grant is made be for a period other than a year, the grant will be increased or diminished by one twelfth for each month more or less than a year; and no grant can be paid for any portion of the year during which Drawing has not been taught in full compliance with the regulations, except that if a School has been closed during the year under medical authority, or for any unavoidable cause, the grant will not be reduced under this rule.

Cards of merit.

22. Cards of merit are given to all scholars who pass with credit the 6th or 7th Standards in Drawing.

Examination of Pupil-Teachers and Ex-Standard (Code) Scholars.

Pupil-teachers and Ex-Standard (*Code*) Scholars.

23. Pupil-teachers and Ex-Standard (*Code*) Scholars in an Elementary School where Drawing is taught may not be examined in the Drawing Standards (§ 13), but they may be examined in the Elementary Stages of Freehand (Subject 2*b*), Perspective (Subject 1*c*), and Model Drawing (Subject 3*a*), respectively; and in Drawing in Light and Shade from a Cast (Elementary Stage of Subject 5*b*), when the rest of the School is examined. The four subjects may be taken in any order, but no candidate may take more than two of the Subjects 2*b*, 3*a*, and 1*c*, and no candidate for examination in Subject 5*b*, Light and Shade Drawing, may take any other subject at the same examination. Pupil-teachers and Ex-Standard Scholars may not be examined in *the same subject* both at an Elementary School and at a School of Art or Art Class *in the same calendar year.*

N.B.—*Perspective will cease to be a subject of examination at Elementary Schools after the* 31*st of August* 1894.

Ex-pupil-teachers.

24. Ex-pupil Teachers remaining in the School, and whose term expires within the year following its examination in Drawing, may attend its next examination, and payments under § 25 may be made on account of their success.

Payments on Pupil-Teachers and Ex-Standard Scholars.

25. Payments of 1*l.* and 10*s.* respectively for a first class or second class in the Elementary Stage of Freehand, Model, Shading from a Cast, and Perspective, and of 10*s.* for a pass in Geometrical Drawing (Science Subject I., Section 1), are made on account of each Pupil-Teacher or Ex-Standard Scholar of the School who has been taught Drawing in the School; but Pupil-Teachers and Ex-Standard Scholars can only be examined in Geometrical Drawing at the May examinations of Science and Art Schools and Classes.

Higher Grade Schools.

26. Grants are not made under the foregoing rules (§§ 19 and 25) for Scholars in a Higher Grade School who are not in the Standards of the Education Code or whose names are not on the Register of the Elementary School. Provision can only be made for their instruction and examination in Drawing under the rules for Art Classes.

27. No payment is made on account of a candidate for whom payment has been previously made for the same or a higher success in the same subject; and the payment for a First Class is reduced by the amount which has been previously paid on account of the same Candidate for a Second Class in the same subject.

Examination of Teachers.

28. Teachers and Assistant Teachers of Schools in places where there is no School of Art may, with the permission of the Managers, be examined in the Subjects named in § 23 at the examinations held under these regulations.

Form 1294 N.
Art.

GRANTS FOR DRAWING IN EVENING CONTINUATION SCHOOLS IN ENGLAND, WALES, AND SCOTLAND.

Annual Grants for Drawing are made by the Science and Art Department to Evening Continuation Schools in England, Wales, and Scotland, under the following conditions:—

1. The course of instruction in Drawing in Evening Continuation Schools may be in accordance with the appended Syllabus, or with one submitted by the Managers and approved by the Department.

2. Managers desiring to have the scholars examined in Drawing must apply for an examination (on Form No. 520 n.) annually, to the Department of Science and Art. Schools beginning work before Christmas should apply before 1st of October, and Schools beginning work after Christmas should apply before 1st of January. They must define exactly on the Form No. 520 n. the part or parts of the Syllabus which the School may have adopted in which the scholars are to be examined. The examination may be held on any evening that may be arranged by the Inspector with the Correspondent of the School. The examination of the Evening Continuation School in a remote district should, if possible, be held on the same day as that of the Day School, so as to avoid the necessity of a second visit from the Inspector. The Inspector may make arrangements for the collective examination, at some convenient centre, of the scholars of two or more Evening Continuation Schools which are in the same neighbourhood, especially if the numbers be small.

3. For the examination the Managers must provide common white cartridge paper cut in sheets of about the size of imperial octavo, or about 11 inches by 7½ inches. For Drawing with instruments and from the Cast, the same or somewhat larger paper, but not exceeding 15 inches by 11 inches, either white or tinted, may be used.

4. The Inspector will, on the occasion of his visit, set the work to be then done by each Scholar, in order to test him in the portion of the Syllabus in which he has been instructed, as indicated on the Form No. 520 n. The work done under these conditions will be sent by the Inspector to the Department with his report.

5. The managers must furnish the Inspector, when he examines the School in Drawing, with a schedule (in Form No. 1274)

giving the names in alphabetical order of all scholars who are presented for examination. There must be a separate schedule for each School when two or more Schools are examined collectively.

6. In deciding whether the instruction in Drawing shall be marked as "Excellent," "Good," or "Fair," the Inspector's general observations upon the instruction, the provision of examples, etc., will be considered by the Department, as well as the work done before him.

7. A grant of 1s., 1s. 6d. or 2s., according as the award to the School is "Fair," "Good," or "Excellent," respectively, is made for each scholar, provided that the Managers certify that—

(a.) the scholar has not been examined in Drawing under the rules of the Department of Science and Art within the three months preceding his examination in Drawing at the Evening Continuation School;

(b.) the scholar has received at least 20 hours' instruction in Drawing in the School year at the Evening Continuation School;*

(c.) the School has met not less than 30 evenings in the School year; and*

(d.) that each scholar on whom the Drawing Grant is claimed has received at least 12 hours' instruction in the School year in one of the other subjects recognised by the Education Department under Article 2 of the Evening Continuation School Code of 1894† and Article 2 of the corresponding Code for Scotland.

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* *The "School year" is the year ending on the 30th April.—Evening Continuation School Code, 1894, Article 9.*

† *The following are the subjects named in Article 2:—*

(a.) *Elementary Subjects*
- *Reading or Recitation, or both combined.*
- *Writing and Composition.*
- *Reading and Writing combined.*
- *Arithmetic.*

(b.) *English Subjects*
- *English.*
- *Geography.*
- *History.*
- *The Life and Duties of the Citizen.*

(c.) *Languages*
- *French.*
- *German.*
- *Welsh (for scholars in schools in Wales).*
- *Latin.*

(d.) *Mathematics*
- *Euclid.*
- *Algebra.*
- *Mensuration.*

8. The annual grant becomes due at the end of the School year, and is paid, upon the receipt by the Department of the claim for it from the Managers, as soon as may be after that date.

9. No scholar may be presented for examination unless—

(a.) provision for teaching Drawing during at least one hour each week be made in the time-table ;

(b.) a separate attendance register for Drawing be kept. In England and Wales this register should be similar to the one kept for each subject as prescribed by Art. 7 of the Evening Continuation School Code. In Scotland the Managers should provide a suitable register.

The register must be marked before the beginning of each lesson unless the number of scholars renders exceptional treatment necessary, in which case a special plan for registration must be submitted to the Department for approval. If any scholar registered as attending is withdrawn before the end of the lesson, the entry of attendance should be at once cancelled. The register must show clearly the number of hours' instruction received by each scholar in Drawing. No lesson of less than half-an-hour in length is recognised for purposes of registration.

10. No scholar may be entered or retained on the register who is under 14 years of age, unless such scholar (a) has been presented for examination in the three elementary subjects in Standard V. or in a higher Standard, or (b) is exempt from the legal obligation to attend the Elementary Day School.

11. The School must be open at all times to the visits and inspection of the Officers of the Department of Science and Art.

(e.) *Science Subjects and Subjects of practical utility.*
- *Elementary Physiography.*
- *Elementary Physics and Chemistry.*
- *Science of Common Things.*
- *Chemistry.*
- *Mechanics.*
- *Sound, Light and Heat.*
- *Magnetism and Electricity.*
- *Human Physiology.*
- *Hygiene.*
- *Botany.*
- *Agriculture*, *Horticulture*, *Navigation* — *in suitable localities.*
- *Book-keeping.*
- *Shorthand.*

(f.) *Vocal Music.*

(g.) *Subjects for Girls and Women only.*
- *Domestic Economy.*
- *Needlework.*

Instruction may be given in other subjects, if sanctioned by the Education Department.

Syllabus for Drawing in Evening Continuation Schools.

Explanatory Note.

The objects of the course of instruction in Drawing in Evening Continuation Schools should be both to provide scholars who have not had an opportunity of going through the entire course of Drawing in the Elementary School with the means of perfecting themselves in the elementary drawing therein provided for, and to assist such scholars or others to carry that instruction forward. A sample syllabus is given below, but Managers are not restricted to it. They may propose a syllabus or scheme of their own. Such alternative syllabus or scheme must be submitted to and approved by the Department of Science and Art before being adopted for use.

Drawing Materials, etc.

The materials to be used in Drawing may be lead pencil, chalk, and water colours. The use of water colours should not be attempted until some mastery in drawing with the pencil and chalk has been acquired.

Practice in drawing with compasses, scales, rulers, curves, and such like instruments should be concurrent with freehand drawing.

The drawings may be done either from flat examples or from actual objects and things, and should be done in outline first of all; the representation of effects of light and shade may be practised subsequently.

Course of Instruction.

The course is divided into sections for the convenience of Managers, but any parts of the course may be proposed.

Section A.

(1.) Freehand Drawing in outline from flat examples of ornamental forms and objects composed of straight and curved lines with a pencil or chalk; with a brush and tint of colour.*

(2.) Drawing in outline with rulers and compasses, enlarged or reduced copies of diagrams of geometrical figures,† and of objects of simple geometrical construction‡, such as simple forms of Building or Machine Construction: and learning how to take measurements of such simple objects.

Section B.

(1.) Freehand drawing in outline from simple objects; (a) having straight lines, such as a salt-box, a ladder; (b) having curved

* *These might be similar, if the Managers desire, to those in Standards IV. and V. of the Elementary School Illustrated Syllabus.*

† *As in Standards IV. and V.*

‡ *As in Standards IV. and V.*

lines, such as a flower-pot, a jug with handle; (c) having straight and curved lines combined, such as a wheelbarrow, an arched doorway, or single flowers and fruits and large leaves.

(2.) Drawing in outline with rulers, scales, and compasses (plans, elevations, and sections) from measurements made by the student himself of actual objects of simple construction, such as a box, a panelled door, three or four steps in a flight of stairs.

(3.) Drawing in outline with rulers, scales, and compasses from diagrams of machines or parts of machines more complicated than those in A. (2): and practice in the representation of varying tones of shadow, and of different materials in building constructions, by lines, and by tints of colour.

Section C.

(1.) Freehand Drawing in outline from Casts of Architectural mouldings, and ornamental forms; or from real fruits, flowers, or plants.

(2.) Drawing in outline with Instruments from Measurements (plans, elevations, and sections) of mechanical objects, such as a cog-wheel, a tap, a door-lock, and chain.

Section D.

(1.) Freehand Drawing in light and shade, with pencil and chalk, from simple objects of domestic use, sprays of foliage, flowers, and fruits, and casts of architectural mouldings, and ornamental forms.

(2.) Practice in arranging colours, by tinting freehand outline drawings of ornament, with not more than 4 flat tints of colour.

(3.) Tinted and shaded drawing with instruments, in ink, tints of colours, etc. (plans, elevations, and sections) from measurements and specifications of objects of simple construction.

Section E.

Freehand drawing in light and shade, with brush and water colours, from objects as in D. (1).

Form No. 813.
Manual Instruction.

Grants for Manual Instruction in Elementary Schools and in Organised Science Schools.

1. Grants are made by the Department of Science and Art towards the maintenance of classes for Manual Instruction in connexion with Elementary Schools in which drawing is taught under the rules in Form No. 1294; or in connexion with organised Science Schools.

2. These grants are subject to the conditions laid down in pars. 4, 5, and 21 of the rules in Form No. 1294, relative to grants for Drawing in Elementary Schools.

3. The instruction must be—

(*a*) carried on continuously throughout the school year for two hours weekly;*

(*b*) in the use of the ordinary tools used in handicrafts in wood or iron;

(*c*) given out of school hours† in a properly fitted workshop; and

(*d*) connected with the instruction in drawing, that is to say, the work must be from drawings to scale previously made by the scholars.

The intention of the rule laid down in par. 3 (*a*), is that the Manual Instruction should be given continuously throughout the School Year for two hours weekly, to all Scholars in respect of whom a grant is to be claimed; and that Scholars in respect of whom a grant is to be claimed, but who are in attendance on the ordinary instruction for a part only of the School Year, should also receive manual instruction for two hours weekly throughout the whole period of their attendance on the ordinary instruction.

4. The instruction may be given by one of the regular teachers of the School, *or centre at which the Manual Instruction is given*, if he is sufficiently qualified; if not, he must be assisted by a skilled artisan, *and care must be taken to make such arrangements as will insure the maintenance of good order and discipline.*

5. The work of the class will be examined by an Inspector of the Department, accompanied, if necessary, by an artisan expert, on the occasion of his visit to examine in drawing.

6. If it appears that the school is properly furnished with plant for instruction, and that the instruction is good, a grant *at the rate*

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* *The "two hours" may include half an hour weekly for the special drawing required under par.* 3 (*d*).

† This condition will be held to be satisfied if the Time-table of the School shows that for every child in the School 20 hours in each week, irrespective of the time assigned to manual instruction for which a grant is claimed from the Department of Science and Art, are given to the other subjects prescribed by the Codes of the English and Scotch Education Departments.

of 2d. a lesson, with the addition of 20 per cent. if the instruction is excellent, will be made for every Scholar instructed, provided *that the Managers certify*—

(*a*) that he *has been placed in the 5th or a higher Standard of the Education Code;*

(*b*) that he has received manual instruction for at least two hours a week for *not less than 15 weeks* during the School Year, *and while he was a scholar of the Elementary Day School attending that School with reasonable regularity;* and

(*c*) that a special register of attendance is kept and supervised by the Managers of the School.

7. The grant may be reduced or wholly withheld at the discretion of the Department if it appears that the plant is insufficient or that the instruction is not good.

8. The managers of the school must inform the Department of Science and Art as soon as manual instruction is commenced in connexion with their school. (Apply for Form No. 620.)

9. If the instruction for which the grant is made be for a period other than a year, the grant will be increased or diminished by one-twelfth for each month more or less than a year. *But no grant will be made unless the instruction has been given continuously for at least 22 weeks, and then only for the first year in which manual instruction is commenced.*

10. In an organised Science School the grant for manual instruction can only be earned on account of a student who has made 250 attendances and been presented at the Science and Art Examinations of the year.

PART III.

AID TO TRAINING COLLEGES FOR TEACHERS.

N.B.—In 1894 *the aid to Training Colleges for Teachers will be given under the Rules of the Directory of June* 1893.

Examinations.

Examinations.

1. The annual examinations in Drawing for Students at Residential Training Colleges only, will be held, about *July in* 1895, at the Residential Training Colleges under the inspection of the English and Scotch Education Departments. The following are the subjects of examination:—

a. Freehand drawing of Ornament (Elementary Stage);
b. Model Drawing (Elementary Stage);
c. Drawing in Light and Shade from a Cast (Elementary Stage); and
d. Model Drawing with chalk upon the blackboard.

2. Students of Residential Training Colleges must be examined in these subjects at the College examinations only, and not at the examinations of a School of Art or Art Class in May.

Day Training Colleges.

3. Students of Day Training Colleges may be examined at the May examinations and earn payments on results in Subjects (*a*), (*b*) and (*c*) par. 1, provided that the College Authorities make the necessary arrangements under the rules for the May examinations. Application for papers must be made in Form 119 in accordance with § XXVII. (see page 11).

Application for the examination in Blackboard Drawing of Students of Day Training Colleges must be made by 31st March, on Form No. 276. The Day Training Colleges will be treated in the same way as regards payments on results as the Residential Colleges so far as these candidates are concerned. See par. 6 (page 100).

4. The marks obtained at these examinations count towards the Certificate granted by the English and Scotch Education Departments.

The Elementary Drawing Certificate.

5. The Elementary Drawing Certificate (First Class) will be granted to Candidates who obtain a First class in the Elementary Stage of—

(*a.*) Freehand Drawing (Subject 2*b*);
(*b.*) Model Drawing (Subject 3*a*);
(*c.*) Shading from Casts (Subject 5*b*); and
(*d.*) A Pass in Section I. of the Elementary Stage of Practical Plane and Solid Geometry (Science Subject I.) *obtained at these Examinations in July* 1895 *only.*

Payments on Results.

Payments.

6. The payments claimable (in Form No. 678) by the Authorities of Training Colleges on account of each student are 15*s.* and 7*s.* 6*d.* for a first class or second class respectively in (*a*), (*b*), (*c*), and (*d*), of paragraph 1, page 99.

Previous success.

No payment is made on account of a student who has been previously successful in a higher Stage of the same subject, or of a corresponding subject in former schemes of examination. If the student has been previously successful in the same Stage of the same subject, or in a corresponding subject, the payment on his account will be reduced by the payment which would be claimable on such previous success; but when such previous success has been obtained in the same College and has not been paid upon, the Department may allow the full claim.

7. These payments are contingent on the employment of a teacher holding the Certificate D., the Elementary Drawing Certificate (*First Class*), or any higher Art Certificate.

Training Colleges in Ireland.

Training Colleges in Ireland.

8. Students of Training Colleges in Ireland may be examined and earn payments on results in Subjects (a), (b), (c), and (d), par. 1 (page 99), provided that the Authorities of each College examined employ a Teacher holding the Elementary School Teacher's Drawing Certificate (D.), the Elementary Drawing Certificate (First Class) or any higher Art Certificate.

The College Authorities must supervise the instruction, and make the necessary arrangements for the examinations, in Subjects (a), (b), and (c) under the rules for the May examinations; and application for papers in these subjects must be made, by the Principal of the College, who will act as Secretary, in Form No. 119 in accordance with § XXVII. (see page 11). Application for the examination in Blackboard Drawing must be made by 31st March on Form No. 276.

The examinations will be conducted by an Officer of the Department.

Payments on results and the conditions attaching to them are the same as those stated in par. 6 (see above), and the payments must be claimed in Form No. 678.

APPENDIX A.

FORMS AND INSTRUCTIONS FOR GUIDANCE IN ESTABLISHING AND MAINTAINING SCHOOLS AND CLASSES.

Forms Common to Science and Art.

Form 170.
S. & A.

MEMORANDA FOR THE USE OF SECRETARIES AND MEMBERS OF SCIENCE AND ART COMMITTEES.

NOTE.—Secretaries of Science and Art Schools and Classes are particularly requested always to quote the "School Number" on all forms sent to the Department, and on all correspondence.

Copies of any of the forms mentioned in the Science and Art Directory which are required by Secretaries may be obtained on application to the Department. An endeavour is made to forestall, as far as possible, the requirements of Secretaries, but the Department undertakes no responsibility for the transmission of forms unless a special application for them has been received.

General Duties.

Visiting School.	To visit the School frequently, see that the regulations of the Department are duly carried out, and that the entries in the Registers are correctly made in Ink, from day to day. (*See* Form No. 1069, p. 110.)
Inspecting Registers.	The Secretary, or other member of the Committee who visits the Class, is requested to record, in the space provided in the Attendance Register, the number of students of that Class present at the time of his visit, and to certify the same with his dated signature. (*See* No. 1069, p. 110.)
Meeting Inspector.	To summon a meeting of the Committee, when requested, on the occasion of the visit of the Inspector. (*See* § XL.).
Custody of Apparatus, &c.	The Committee are responsible for the safe custody, on the premises, of all the apparatus, examples, casts, &c. purchased with aid from, or lent by, the Department; the Committee should meet and inspect such objects at least once a year, and the Secretary should fill up annually the certificate on Form No. 120, stating their condition.

Calendar of Specific Duties, with dates for Special Returns during the Session.

The Department recognises as a session the 12 months from one May examination to the succeeding May examination.

On opening or re-assembling of School.	Form No. 120, informing the Department of the formation of a new School or Class, to be carefully filled in and sent prior to its opening. (*See* Form No. 990.) If the School have a class in Practical Chemistry, or in Practical Metallurgy, the space provided on the fourth page of Form No. 120 should be filled up. (*See* Science sec. 18, p. 31.) As soon as Form No. 120 is received the necessary registers will be sent to the Secretary. (*See* Form 1069, p. 111.) An old School or Class should send Form No. 120 before re-commencing work after the examination. Whether from an old or from a new School, unless Form No. 120 is received before the 1st October the Department may refuse to make payments on the results of the next examinations. The acceptance of Form No. 120 after the 30th September will be exceptional, will be subject to a deduction from the grant, and Schools from which Form No. 120 has not been received before the 1st October will not be included in the Calendar of the Department.
Reporting Changes.	Although the arrangements for the current session returned on Form No. 120 (*see below*) are not necessarily final, they must be adhered to until a letter intimating the intended alterations has been sent to the Department, and its receipt acknowledged. The Secretary should, therefore, report any changes in the Teaching Staff; in the subjects of instruction; in the days and hours of meeting of the Classes; in the constitution of the Committee; in the address of the Secretary or Teacher; and any other particulars of importance. The necessity of strict attention to this requirement is obvious, as those lessons only which are given on days and between hours previously reported to the Department, and which are given by teachers of whose appointment it has approved, and in buildings which it has recognised, can be registered or counted towards the number necessary to secure payments on the results of the examinations.
Reduced Grant.	When owing to an omission to report changes in the time-table as returned on Form No. 120 an Inspector fails to see a class under instruction, the cost or a part of the cost of his visit will be deducted from the next grant paid to the Committee.
Before 1st August.	Submit names of successful competitors for Science and Art Scholarships on Form No. 281. Where an organised Science School has been formed in accordance with provisions of Science Sections 22–28, submit time-table on Form No. 122. N.B. The School year of an organised Science School is held to terminate on the 31st July.
Before 1st September.	Report where Local Exhibitioners will pursue their studies. Furnish certificate on Form No. 1,066 that Science and Art scholars are progressing satisfactorily.
Before 1st October.	If a loan of one of the collections of Scientific Apparatus prepared for circulation to Science Schools is desired, send in Form No. 802. (*See* § XLIX. and p. 120.)
Attendance Registers.	**Attendances at instruction in any subject of Science or in any Art Group after the Examination in such Subject or Group are to be recorded in a new copy of the attendance register.**

In October	Form No. 88, forming the Committee, or, if it be an old School, Form No. 168, continuing the Committee, to be sent in as soon as possible after the May examinations. Unless the one or the other form be received by the 31st October (except the Committee has been duly recognised as permanent—*See* § IX. sec. 1 and § X. sec. *c*) the Department may refuse to make payments on the results of the next examination, and if these are exceptionally allowed they will be reduced. Any alterations which the Department may indicate as necessary must be made by the 31st January, so that the Committee may receive at least the Department's provisional approval by that time, or the School or Class will not be allowed to participate in the ensuing examinations. (*See* § X.)
Irish Schools	See Special Rules for Science Schools in Ireland, Directory, p. 56.
Before 16th January.	Send in Form No. 1175*b* or 1170, application for a local examination in Elementary Modelling.
Before 10th February.	Local Committees desirous to appoint a Special Local Secretary for conducting the Science and Art Examinations for the town or district in which they are situated should apply to the Department.
Before 24th February.	Committees to discuss the arrangements for the receipt, safe custody, and distribution of the examination papers for use in the district, and to nominate, on Form 1116A or Form 1116C, a custodian of examination questions for the approval of the Department. (*See* § XXX.)
Before 16th March.	In places where a Special Local Secretary has been appointed, or an Amalgamated Examination Committee formed, Form No. 119 to be sent not later than 16th March to the Special Local Secretary or the Secretary of the Amalgamated Committee, as the case may be, for transmission to the Department before the 21st March. (*See* § XXVII.)
Before 21st March.	In places where neither a Special Local Secretary has been appointed, nor an Amalgamated Examination Committee formed, the Secretary of the Local Committee must before the 21st March send to the Department Form No. 119, giving the precise number of candidates for examination in each subject specified in that Form. (*See* § XXVII.) Applications for examination in Practical Chemistry and Practical Metallurgy must be made on Form No. 1010.

Note.—Care must be taken that application be made to the Department for all the papers of examination questions which are required in each subject on Form No. 119 or Form No. 1010. As the number of candidates allowed to sit in any subject must not exceed the number of papers applied for, additions to or alterations in Forms Nos. 119 or 1010, after their transmission to the Department, will only be permitted under very exceptional circumstances, and no addition or alteration can, under any circumstances, be made after the 21st of March. No Examination will be held in Schools from which Form No. 119 or 1010 has not been sent before the 16th or 21st March in accordance with the above paragraphs. Applications made after the proper date or such as have not been made strictly in accordance with the rules will not be entertained.

In April	Before the examinations commence, the Secretary of the Local Committee of a School or Class which is to resume work immediately after the examinations are

over should apply to the Department for Form No. 120. This form should be filled up with particulars of the instruction to be given after the examination, and, as far as possible, in other respects. When Form No. 120 is returned to the Department the Secretary will be supplied with the registers which the time-table on Form No. 120 shows to be necessary. The School or Class will thus be enabled to record attendances at instruction in any subject of Science or in any group of Art after the date of the examination in such subject of Science, or after the last examination in such group of Art, in a new copy of the attendance register as required by the regulations.

BEFORE 6TH APRIL — Application for Science and Art Scholarships to be made on Form No. 280, for Local Exhibitions on Form No. 286.

ON 9TH APRIL - — To send to the Department the Science and Art works for examination for payments and certificates with Form No. 528. (*See* § XVIII., Science sec. 19, and Art sec. 21.)

BEFORE 15TH APRIL. — To request candidates for Whitworth Scholarships and Exhibitions to send in Form No. 330; candidates for Royal Exhibitions, National Scholarships, or Free Studentships in Science to send in Form No. 330*a* (*see* Science, secs. 33 and 34); and candidates for Local Scholarships and Royal Exhibitions in Art to send in Form No. 1181 (*see* Art sec. 35).

ON THE 19TH APRIL. — To see that Science Form No. 91 (for Schools in Ireland, No. 91B) or Art Form No. 965c is hung up in the schoolroom.

Warn all candidates for examination to be present at least 10 minutes prior to time fixed for its commencement.

In Ireland examinations commence half an hour, by Dublin time, earlier than the times stated on the Time Tables, pp. 27, 28, 69, 71.

ON THE 25TH APRIL (FOR SCIENCE). — If a parcel containing (1) the papers for the candidates to work upon, (2) copies of Form No. 91 (or Form No. 91B for Schools in Ireland), one for each subject of examination, and (3) canvas bags in which to return the worked papers, should not have been received, or if there should be any mistake in the number sent for each subject as applied for, or in the covering letter, to communicate AT ONCE with the Department.

DURING THE MAY EXAMINATIONS. — The examination questions for Science and Art subjects for each evening will be sent to the duly appointed local custodian in registered letter packets, so as to arrive on the morning of the day of examination, or possibly the evening before. The local custodian must arrange for the receipt of the packets, and for their safe custody, until the examination commences. (*See* § XXIX.)

ON THE EVENING OF EXAMINATION. — To have in the Examination Room on each night of examination the General Register of the School (Form No. 486), posted up with an accurate list of the members of the Committee approved by the Department for the current session. (*See* Form No. 1069, p. 110.)

To adhere rigidly to the letter of the rules on Forms No. 91, 91B, 91D, 91E, 91F, 91M, or 965c. To sign a Form No. 91, 91B, 91D, 91E, 91M or 965c, for each

subject of the Science or Art Examinations. To fasten up the papers in one of the canvas bags provided, the specimens and paintings in the other packings provided, and at once post them.

BEFORE 10TH JUNE — To request candidates competing for Royal Exhibitions, National Scholarships, Free Studentships in Science, or Whitworth Scholarships and Exhibitions to return Form No. 400 (*see* Science secs. 33 and 34), and candidates competing for Local Scholarships and Royal Exhibitions in Art to return Form No. 1202 (*see* Art, sec. 35).

AFTER THE ANNOUNCEMENT OF THE RESULTS OF THE EXAMINATIONS. — On receiving the lists of the results, to communicate the contents to the Teacher and to each candidate whose name appears in them, and to distribute to the successful candidates the cards or certificates recording their success. These will be sent as soon after the examination as they can be prepared, but the Department cannot guarantee their delivery by any specified date.

In cases where prizes are claimable to return, as soon as possible, Science Form No. 161, and Art Form No. 571*d*, filled up in strict accordance with the rules under which prizes are granted. Applications for prizes will be forwarded to the Department's agents for execution in the order in which they are received, but the Department cannot guarantee the delivery of prizes by any specified date. To call a meeting of the Committee to examine and certify the claims for payment (Science Form No. 51 or 51A, and Art Form No. 526,) and the General and Attendance Registers, which must be sent, together with the claims for payments and prizes, to the Department as vouchers in their support.

Apply for payment of grant for Science and Art Scholars on Form No. 282, and apply for renewal of Scholarships on Form No. 473.

It is requested that all claims for payments or prizes be made as soon as possible after the results of the examinations at which they are earned have been communicated to the School.

To keep a record of, and inform the Department of the number of individuals examined.

Note.—A deduction of half-a-crown is made from the next payment to the School for every day's delay in sending in a Form, Return, or Works.

Official communications should be written upon good foolscap paper and sent in envelopes addressed to the Secretary, Department of Science and Art, London, S.W. The postage need not be prepaid, and it is particularly requested that Post Cards and Correspondence Cards may not be used.

To each of the Forms Nos. 51, 51A, 88, 88B, 88C, 120, 120A, 122, 168, 1104, and 1160 is attached a slip. If this slip is filled up by the person transmitting the form it will be detached, stamped with the dated official stamp, and returned to the sender as an acknowledgment that the form in question has reached the Department.

Form 88.
S. & A.

This form should be sent in as soon as a committee is formed. Unless it is received by the 31st October, the Department may refuse to make payments on the results of the next Examinations. The acceptance of the form after that date will be exceptional, and will be subject to a deduction from the grant.

*School Number ———

RULES FOR FORMATION AND CONTINUANCE OF LOCAL COMMITTEES FOR SCHOOLS AND CLASSES RECEIVING AID THROUGH THE DEPARTMENT OF SCIENCE AND ART.

1. Every Science or Art School or Art Class in connection with the Department of Science and Art must be under the superintendence of a Committee. A Local Committee may, with the sanction of the Department, supervise classes meeting in different places, but the Department will not recognise more than one Committee for the supervision of instruction given in any one building.

Committee to consist of at least five members.

This Committee must consist of a Chairman, a Secretary, and at least three other members. The offices of Chairman and Secretary cannot be held by the same person. All the members of the Committee must be well-known responsible persons of independent position, who have no personal interest in the Teachers of the School.

The following are not eligible to be members of the Committee:—Candidates for examination by the Department or their Teachers in ANY subjects; relatives of teachers under the Department; teachers of schools which have candidates for examination, and teachers of schools receiving Government grants. A member of Committee must not take any part in an examination at which a relative of his is a candidate.

Chairman and at least one other member must be of position defined.

2. It is very desirable that as many persons as possible in recognised positions of public responsibilty in the district, such as Mayors, Provosts, Town and County Councillors, Magistrates, Members of School Boards, Trustees of Grammar Schools, Clergymen of the Established Church in parochial employment, and Ministers of Religion in charge of legally recognised places of public worship, should be on the Committee. It is ABSOLUTELY NECESSARY that at least two such responsible persons should agree to act. The Chairman, who will be required to certify that the constitution of the Committee is in accordance with the above requirements, must be in a position of public responsibility as defined above.

Intending members to be acquainted with their duties and sign this form.

3. The persons† who intend to act on a newly constituted Local Committee must sign and complete this form. No one can be a member of the Committee, or assist in the conduct of an examination, whose membership has not been PREVIOUSLY approved by the Department. Care must be taken that the members are properly acquainted with their duties; a summary of which is given below (see § 5). The details of these duties are fully stated in the

* The space here may be left blank, but when the Committee is approved, a number will be assigned to the school, and this number should appear upon *all* communications subsequently addressed to the Department.

† Ladies may act on a Local Committee. On signing this form they should state whether they are spinsters, married women, or widows. Where they have themselves no occupation, spinsters should give the past or present occupation of their fathers, and married women and widows that of their husbands.

Science and Art Directory, which may be obtained on application to the Secretary of the Department.

4. When a school or class is first formed, the following undertaking must be signed AT A GENERAL MEETING OF THE COMMITTEE. Mode of formation of Committee.

SUMMARY OF DUTIES.

5. The Department requires that the Local Committee shall—

a. Provide and maintain a room or rooms for the class instruction, with firing and lighting, together with such apparatus and examples as are required to illustrate the instruction. Be responsible for the safe custody on the school premises of all apparatus and examples towards the purchase of which the Department has granted aid, or which it has lent. Custody of apparatus and examples.

b. Provide a room or rooms of sufficient size to carry out the annual examination according to the detailed regulations prescribed in the Science and Art Directory. To this examination ALL persons who wish to present themselves, and not only those attending the school or class, must be admitted, provided that they have given due notice according to the rules. Persons who do not belong to the school or class may be required to pay the authorised fee for each subject in which they register their names for examination. Arrangements for examination.

c. Frequently visit the school during the attendance of the Science and Art classes; sign the attendance register and enter in it the number of students present, and take care that the school registers (Science and Art Forms Nos. 486, 486A, and 486B), showing the occupations of the students, their attendances, payments of fees, &c., are kept from day to day, in accordance with the regulations in Form No. 1069, and sent to the Department of Science and Art, together with the claim for payment on the results of the examinations. Visiting classes, inspecting and signing Registers.

d. Send to the Secretary of the Department, to the Special Local Secretary, or to the Secretary of the Amalgamated Committee (in Form No. 119 or Form No. 1010), a list of the students to be examined, specifying the subjects in which they are to be examined. Superintend, if required, the examinations in accordance with the rules of the Department; give out the examination papers which will be sent for that purpose; see them fairly worked and certify the same, the number of members of the Committee required by the regulations to act as superintendents being ALWAYS present; and send the worked papers, under seal, by the day's post to the Secretary of the Department. (When a Special Local Secretary is appointed by the Department, the Committee is relieved of a part of this work. *See Science and Art Directory, § XXII.) Holding examinations.

e. When required, transmit to the Department for examination works executed in the school or class during the previous year, and make an annual report of its proceedings. Forwarding works and annual report.

f. Certify that the students, on the result of whose examination claims for payment are made, belong to the industrial classes as defined by the Science and Art Directory, § XXXII., and that the payments claimed are due according to the regulations. Certifying claims.

g. Certify that during the session the required number of lessons have been given in each subject by a duly qualified teacher, and that all students, on account of whose instruction payments or prizes are claimed, have received at least 20 such lessons since the last examination at which they were successful, each lesson being an attendance at a meeting of the class of at least an hour's duration on a separate Certifying Number of Lessons.

* Local committees desirous to appoint a special local secretary for conducting the Science and Art examinations in the town or district in which they are situated should apply to the Department before the 10th February.

day. That 20 lessons have been given since the last examination in the subject at which the candidate was successful; within two years immediately preceding the examination on account of which the claim is made, and under the supervision of this Committee.

School open to Department.

5. Undertake that the School, with all its apparatus and examples, shall be at all times open to the visit and inspection of the Officers of the Department.

Committee to meet Inspector.

6. The school or class will be inspected periodically by an officer of the Department, who will report whether the regulations are strictly carried out. A meeting of the Committee must be held to receive the Inspector if he should so require in giving notice of his visit; at such meeting as many of the members as possible are expected to attend.

FORM of APPLICATION to act as a COMMITTEE for a SCIENCE or ART SCHOOL or ART CLASS receiving AID through the DEPARTMENT of SCIENCE and ART.

Directions.

To be sent on the formation of school or class.

This form is to be filled in, signed at a general meeting of the Committee, certified by the Chairman, and returned to the Department IMMEDIATELY on the formation of a local committee.

Latest dates for return and alterations to secure grants.

This form must be sent in by the 31st October, and any alterations considered necessary by the Department be made before the 31st January.

Continuance of committee.

Should this Committee continue to act for next session, Form No. 168 should be filled in with the names of all the old members who consent to continue to act on the Committee, as well as those of any new members added to the old Committee, and be transmitted to the Department.

When it is desired to add new members to the Committee during the progress of any session such new members should sign the undertaking on Form No. 882, which after having been duly certified by the Chairman of the Committee should be returned to the Department.

Undertaking.

We, the undersigned, declare that we have read the rules for formation and continuance of Local Committees, the summary of duties, the directions and the undertaking given herein, and that in accordance with them we propose to act as the Local Committee for the

_____ [Science School, School of Art, or Art Class.]*

held at the _____ [Name of Institution or Building.]†

_____ [Name of Street or Place.]†

_____ [Name of City, Town, or Village, if not a Post-town state Post-town.]†

_____ [Name of County.]

and taught by _____

_____

_____ [Give the names of all the teachers.]

* State which in the blank space.
† Strike out the words printed in brackets which do not apply.

N.B. If this Committee acts for more than one School the names of the different buildings in which they are held must be distinctly stated above.

And we undertake till the 31st August 189 , or until another Committee satisfactory to the Department of Science and Art has been appointed, the several duties and responsibilities herein detailed.

Signature.	Address.	Occupation.	N.B.—Members holding positions of public responsibility as defined in paragraph 2 of this form, should give particulars in this column.
Chairman.			
Secretary.			Secretary's occupation.

Secretary's name, style, and address in full, as envelopes should be addressed.

I certify that all the above are autograph signatures affixed in my presence at a general meeting, and that this Committee complies with the requirements of the Rules 1 and 2.

Chairman.

Form 1069.
S. & A.

INSTRUCTIONS FOR KEEPING REGISTERS.

N.B.—Unless these instructions are strictly observed the grant may be reduced, or withheld.

All Registers must be kept on the School premises, and be always available for inspection by the Committee or by the Inspector of the Department.

THE GENERAL REGISTER.

REGULATIONS FOR SCIENCE AND ART.

1. In this Register, Form No. 486, the name, autograph signature, age, address, occupation, and previous success (if any) of students must be entered, in ink, immediately on his joining the Science or Art school or class. The list of the Local Committee should also be entered and kept up to date.

2. This Register must be sent from all Schools of Art and Branches of Schools of Art; and from all Science Schools and Art Classes which have not been inspected during the session, with the claim for payments on results, to the Secretary of the Department, who will return it to the Secretary of the Local Committee, after examination, provided Form No. 120, for another session has been sent to the Department.

3. When this Register is returned to the school successes which students may have obtained subsequently to the entry of their names must be duly posted up against that entry. A student will thus retain the same identifying number in this register during all the sessions in which he may belong to the classes.

4. The Register is to be kept on from year to year, and a fresh copy should only be applied for when there is insufficient space in the old Register for the requirements of the current session. A new General Register must be commenced with the number next to that with which the old General Register concluded. The old and new General Registers will both continue in use, the new students' names, &c. entered in the new General Register, and the record of the old students continued in the old General Register.

5. The General Register must be kept on the school premises, and be always available when the inspector or members of the Committee visit the classes and the examinations.

THE ATTENDANCE REGISTER.

REGULATIONS FOR SCIENCE AND ART.

6. The student's number in the General Register must be repeated against his name in the Attendance Register; the numbers in the General Register are required to be consecutive, and the numbers in the Attendance Register will not necessarily be consecutive.

7. The attendance of students must be registered, and the record of their attendance or absence must be entered next to the last lesson recorded. No blank columns may be left. In cases where there is insufficient space in the Attendance Register to record attendance at all the lessons which are to be given during the session, the Department will, on application, supply interleaves for the Attendance Register.

8. Members of the Committee who visit the classes should record on the front of the Attendance Register the number of students present, attesting

the same by their dated signatures; they should also see that the Registers are properly kept.

9. The Attendance Register may be used for one session only, and is retained by the Department; it must accompany the General Register when the claim is sent to the Department. When Form No. 120 is received a fresh Attendance Register will be issued, and as the arrangements for the session on Form No. 120 are not necessarily final, they can be varied with the sanction of the Department.

10. The Secretary of the Local Committee, when forwarding the Attendance Register to the Department, is requested to retain a memorandum of such information as he will require in order to fill up the Annual Report, Form No. 120.

Regulations for Science only.

11. A separate copy of Form No. 486*a* must be used for each subject of Science taught, and for each Division *a* and *b* of Subject VI., and *a*, *b*, and *c* of Subject VIII.

Practical Inorganic Chemistry (Science Subject X. *p*), Practical Organic Chemistry (Science Subject XI. *p*), and Practical Metallurgy (Science Subject XIX. *p*), are each treated as a separate subject. Attendance at instruction in these subjects must not be recorded in registers used for Inorganic Chemistry (Science Subject X.), Organic Chemistry (Science Subject XI.), and Metallurgy (Science Subject XIX.).

Lessons may not be registered in more than two subjects of Science for a student on any one day, except on Saturdays, when lessons in three subjects may be registered.

No student may be recorded more than once upon any one day as present at instruction in any one Science Subject.

12. The presence or absence of each student must be entered IN INK during the actual meeting of the class; his presence is to be indicated by the letter "p" and his absence by *a firm horizontal line thus* ——; and no student may be recorded as present, unless his attendance at the lesson in question extends over a full hour and a half in Practical Chemistry or Practical Metallurgy, or over a full hour in any other subject. The total number of students present at each meeting of the class must be entered at the foot of that column in which their attendance for the day is recorded, and such entry is to be made when the register is marked, and to be verified by the teacher's initials; SUBSEQUENT ALTERATIONS AND POSTING UP OF ATTENDANCES OR OF TOTALS IS PROHIBITED.

Should a mistake in registration occur the fact must be reported, before the next lesson, to the Secretary of the Committee, who will note the circumstances upon the register with his dated signature affixed.

Regulations for Art only.

13. All the attendances of a student who is receiving instruction in Art must be recorded in a single copy of this Register. When necessary, interleaves will be supplied on application.

14. Lessons must not be registered in more than two of the following groups of subjects for a student on any one day except on Saturdays, when lessons in three groups of subjects may be registered, and no student may be recorded more than once on any one day as present at instruction in any one group. For registration purposes the subjects are grouped as follows:—

Group A. Drawing.	Group B. Architecture.	Group C. Theory and Designing.
Freehand drawing of ornament (subjects 2*b* and 3*b*).	Architecture (subject 1*d*).	Principles of ornament (subject 22).
Model drawing (subjects 3*a* and 5*a*).	Architectural design (subject 23*b*).	Historic ornament (subject 22*d*).
Drawing in light and shade from a cast (subject 5*b*).	Perspective (subjects 1*c* and 1*e*).	Design (ornament). (Elementary and advanced stages, subject 23*c*).
	Mechanical drawing (subjects 1*b* and 23*a*).	

NOTE.—Attendances in Science Subject I. qualify for payments on results of examinations in Perspective.

Group D. Painting.	Group E. Study of the Figure.	Group F. Modelling.
Painting ornament in monochrome (subject 11*a*). Painting from still life (subject 15).	Anatomy (subject 9). Drawing and painting from the life (subjects 8*c*[2] and 17*c*). Drawing and painting from the antique (subjects 8 and 16). Design (ornament); Honours, subject 23*d*).	Modelling (elementary stage, subject 18*a*). Modelling design (elementary and advanced stages, subject 23*e*, and Honours, subject 23*f*). Modelling from the life (subject 19*h*). Modelling from the antique (subject 19*i*).

15. The presence of a student must not be entered until he has given at least a full hour's attendance, and then the entry must be made IN INK during the actual meeting of the Class. The absence of a student must be entered at the last meeting of the class on that day, when the total number of students present during the day is to be made up and initialed by the teacher giving the instruction. SUBSEQUENT ALTERATIONS AND POSTING UP OF ATTENDANCES OR OF TOTALS IS PROHIBITED.

Should a mistake in registration occur the fact must be reported, before the next lesson, to the Secretary of the Committee, who will note the circumstances upon the register with his dated signature affixed.

16. In the Art Attendance Register (Form No. 486*b*) the presence of a student must be recorded by the Roman capital of the group A, B, C, D, E, or F, in the subjects of which he is on that occasion receiving instruction; his absence must be recorded by *a firm horizontal line, thus* ——. When a student is under instruction in three groups on Saturday or in two groups on other days, the letters of those groups will be placed against his name in the dated column for the day, *e.g.*, $\frac{A}{D}$ or $\frac{C}{E}$.
$\frac{}{F}$

Form 555.
S. & A.

BUILDING GRANTS FOR SCHOOLS OF SCIENCE OR ART.

Department of Science and Art,
London, S.W.

SIR, day of 189 .

I AM directed to inform you that in order to obtain a Grant in aid of buildings for Science or Art Schools, application must be made on the enclosed form (Form No. 348).

I am also to request your attention to the general rules on the following pages which have been laid down to guide applicants for a Grant in the laying out and construction of the buildings, preparation of the trust deed, &c.

I have, &c.

REGULATIONS UNDER WHICH BUILDING GRANTS ARE MADE TO SCHOOLS OF SCIENCE OR ART.

A.—PRELIMINARY.

1. Grants are made to aid in—
   a. Erecting suitable buildings for Schools of Science or Art.
   b. Erecting suitable rooms as parts of, or as additions to, buildings to be used for other purposes.
   c. Acquiring and adapting buildings already erected.

The buildings (or portions of them) in respect of which a grant is made must be secured to the purposes of a School of Science or of Art as laid down in Section 17, *infra*.

2. Application for the grant must be made by the Committee of the School, or if it be established under the Public Libraries Act, or the Technical Instruction Act, 1889, by the Local Authority administering the Act.

3. All applications for grants out of the Parliamentary Vote for any year must be sent in on or before the 1st day of November in the year preceding.

4. A grant is made to a School of Science only if it is built—
   a. Under the Public Libraries Acts; or
   b. In connexion with a School of Art aided by a Building Grant from the Department of Science and Art; or
   c. Where the Local Authority levies a rate in accordance with the provisions of the Technical Instruction Act, 1889.

5. A grant will not exceed 2*s.* 6*d.* per square foot of internal area, or one half the amount provided either by voluntary contributions or by local rate, raised under the Technical Instruction Act or the Public Libraries Acts, or by both; and no grant will exceed 500*l.* on a School of Science, and 500*l.* on a School of Art.

6. No grant will be made unless the Department is satisfied—
   a. That there is a population in the neighbourhood which requires a School of Science or Art.
   b. That the School is likely to be maintained in efficiency.

7. The site, plans, estimates, specifications, title and trust deed must be satisfactory to the Department of Science and Art.

B.—THE SITE.

8. A plan of the site must be forwarded, showing the boundaries, approaches, and abuttals, and the directions of the points of the compass.

9. The site must be—
   a. In situation, not unhealthy, nor noisy; and within convenient distance of the homes of the students.
   b. In tenure, fee-simple, without incumbrance, or reservation of rights over the surface, or of minerals.*

* A leasehold site is not admissible if the fee-simple can be obtained; and no lease with a shorter term than 99 years, or with more than a nominal rent, is admissible.

C.—The Plans.

10. Plans, sections, and elevations on a scale of 8 feet to an inch, accompanied by the specifications and an estimate of the cost of the building, must be submitted for approval with the application.

11. The size and number of rooms will depend on local circumstances, and the different subjects to be taught in the School.

12. The following general regulations should be adhered to:—

(*a.*) The rooms for study should be not less than 15 feet high to the wall plate, if ceiled flat, or 12 feet high to the wall plate if ceiled to the collar-beams or the common rafter.

(*b.*) The windows should be large, and in Art Schools, free from mullions or small panes.

(*c.*) The class-rooms should, as far as possible, communicate with each other directly as well as by passages. When there are more storeys than one, the staircase should give access to all rooms without passing through rooms; also to cloak-rooms, lavatories, &c. The arrangements for lighting with gas, for warming, drainage, &c. should be complete. The rooms should be well ventilated by the admission of air below the gas lights, and by the extraction of vitiated air by means of shafts carried up above the roof.

(*d.*) Waterclosets, urinals, and a lavatory must be provided; the accommodation for female students must be separate.

(*e.*) The external walls of the school, if of brick, should not be less than one brick and a half in thickness; and if of stone, not less than 20 inches in thickness. All the roofs must be either tiled or slated. Gutters and drains to carry away the roof-water must be provided.

(*f.*) If the roof be unceiled to the tie-beam or collar-beam, there must be ceiling to the rafters. Rooms which are top-lighted should in all cases be ceiled to the common rafters in order to give increased height; and all tie-beams or other heavy roof-timbering should be avoided, and iron tie-rods used where practicable.

13. No grant will be given for a School of Science unless there be a room properly constructed and fitted up for lectures on experimental science, and at least one room properly arranged as a laboratory for practical work in one or more subjects of Science.

14. For a School of Art the following dimensions are considered to afford adequate provision for 50 students. Proportionately increased accommodation must be provided for greater numbers.

a. One Elementary room 20 × 30 feet. This room should be not less than 16 feet high, and may be lighted by skylights as well as by side windows.

b. One room for study from Life or Life-size casts, not less than 20 × 24 feet. This room should be lighted from the north side by a single large window, the top of which (carried up in a dormer if necessary) should be at a height above the floor equal to $\frac{2}{3}$ the depth of the room, or if the pitch of the roof be steeper than 60°, a skylight should be made in continuation of the windows, so as to gain the same effect in lighting.

c. One modelling room 20 × 15 feet.

d. One master's room 12 × 15 feet. This room should be lighted by a side light from the north, if possible.

e. One cloak-room for females 12 × 8 feet 6 inches.

f. A kitchen and bedroom for the attendant, each 12 × 10 feet.

15. In the case of the purchase of buildings already erected, they must be certified by an officer of the Department to be suitable in all respects for the purposes of the School.

16. The plans (with specifications and estimates), when approved and sealed may be returned to the promoters for use, but must be lodged in the Department of Science and Art before a grant is paid.

D.—The Trust Deed.

17. In the case of a school established under a committee the premises must be conveyed to Trustees under a deed, which must provide—

a. That the building be used in perpetuity* and solely, in the case of a School of Art, as "a School for the Instruction of Children and "Adults in Drawing, Painting, Modelling, Designing for Archi-"tecture, Manufactures, and Decoration," and in the case of a School of Science as "a School for the Instruction of Children and "Adults in the pure and natural Sciences applicable to Industry "and Manufactures."

b. That it shall be open at all times to the inspection of the officers of the Department of Science and Art.

c. That the students shall be instructed by teachers qualified to earn payments from the Department on the result of their teaching.

d. For the constitution and renewal of a body of responsible trustees, and of a committee of management.

18. In the case of a School established by a Local Authority that body must enter into a covenant embodying the above provisions *a*, *b*, *c*, of § 17.

19. The trust deed, or covenant, must not be executed until it has been approved in draft by the Department of Science and Art.

20. When a trust deed has been executed, and, if necessary, enrolled, it must be submitted to the Department of Science and Art, together with the approved draft, and a copy, including all signatures, attestations, and endorsements, made on plain unstamped paper. This copy will be retained, and the original deed and draft returned to the promoters. When a covenant has been executed it must be sent to the Department together with the approved drafts, which latter will be returned.

E.—Payment of Grants.

21. The grant is paid on presentation of a certificate (with balance-sheet annexed), by the Building Committee of the School, setting forth that the building and conveyance are duly completed, and that the money in hand will, when added to the grant, meet all claims, and finally close the account.

22. Grants are treated as lapsed if unpaid at the end of 18 months, from the date of announcing them.

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* If any power of sale, or of appropriating the premises to other uses than those of a School of Science or Art, be reserved, the deed must contain a condition securing the repayment of the grant to the Lords of Her Majesty's Treasury.

TECHNICAL INSTRUCTION ACT, 1889.

52 & 53 Vict., Chapter 76.

An Act to facilitate the Provision of Technical Instruction.

[30th August 1889.]

BE it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

Power for local authority to supply or aid the supply of technical instruction.

1.—(1.) A local authority may from time to time out of the local rate supply or aid the supply of technical or manual instruction, to such extent and on such terms as the authority think expedient, subject to the following restrictions, namely:—

(*a.*) The local authority shall not out of the local rate supply or aid the supply of technical or manual instruction to scholars receiving instruction at an elementary school in the obligatory or standard subjects prescribed by the minutes of the Education Department for the time being in force:

(*b.*) It shall not be required, as a condition of any scholar being admitted into or continuing in any school aided out of the local rate, and receiving technical or manual instruction under this Act that he shall attend at or abstain from attending any Sunday school or any place of religious worship, or that he shall attend any religious observance or any instruction in religious subjects in the school or elsewhere: Provided that in any school, the erection of which has been aided under this Act, it shall not be required, as a condition of any scholar being admitted into or continuing in such school, that he shall attend at or abstain from attending any Sunday school or any place of religious worship, or that he shall attend any religious observance or any instruction in religious subjects in the school or elsewhere;

(*c.*) No religious catechism or religious formulary, which is distinctive of any particular denomination, shall be taught at any school aided out of the local rate, to a scholar attending only for the purposes of technical or manual instruction under this Act, and the times for prayer or religious worship, or for any lesson or series of lessons on a religious subject, shall be conveniently arranged for the purpose of allowing the withdrawal of such scholar therefrom;

(*d.*) A local authority may, on the request of the school board for its district or any part of its district, or of any other managers of a school or institution within its district for the time being in receipt of aid from the Department of Science and Art, make, out of any local rate raised in pursuance of this Act, to such extent as may be reasonably sufficient, having regard to the requirements of the district, but subject to the conditions and restrictions contained in this section, provision in aid of the technical and manual instruction for the time being supplied in schools or institutions within its district, and shall distribute the provision so made in proportion to the nature and amount of efficient technical or manual instruction supplied by those schools or institutions respectively;

(*e.*) Where such other managers of a school or institution receive aid from a local authority in pursuance of this section, the local authority shall, for the purposes of this Act, be represented on the governing body of the school or institution in such proportion as will, as nearly as may be, correspond to the proportion which the aid given by the local authority bears to the contribution made from all sources other than the local rate and money provided by Parliament to the cost of the technical or manual instruction given in the school or institution aided;

(*f.*) If any question arises as to the sufficiency of the provision made under this section, or as to the qualification of any school or institution to participate in any such provision, or as to the amount to be allotted to each school or institution, or as to the extent to which, or mode in which, the local authority is to be represented on the governing body of any such school or institution, the question shall be determined by the Department of Science and Art: Provided that no such provision, out of any rate

raised in pursuance of this Act, shall be made in aid of technical or manual instruction in any school conducted for private profit; and

(*g*.) The amount of the rate to be raised in any one year by a local authority for the purposes of this Act shall not exceed the sum of one penny in the pound.

(2.) A local authority may for the purposes of this Act appoint a committee consisting either wholly or partly of members of the local authority, and may delegate to any such committee any powers exerciseable by the authority under this Act, except the power of raising a rate or borrowing money.

(3.) Nothing in this Act shall be construed so as to interfere with any existing powers of school boards with respect to the provision of technical and manual instruction.

Provision for entrance examination.

2. It shall be competent for any school board or local authority, should they think fit, to institute an entrance examination for persons desirous of attending technical schools or classes under their management or to which they contribute.

Parliamentary grants in aid of technical instruction.

3. The conditions on which parliamentary grants may be made in aid of technical or manual instruction shall be those contained in the minutes of the Department of Science and Art in force for the time being.

Provisions as to local authorities.

4.—(1.) For the purposes of this Act the expression "local authority" shall mean the council of any county or borough, and any urban sanitary authority within the meaning of the Public Health Acts.

(2.) The local rate for the purposes of this Act shall be—

(*a*.) In the case of a county council, the county fund;

(*b*.) In the case of a borough council, the borough fund or borough rate;

(*c*.) In the case of an urban sanitary authority not being a borough council, the district fund and general district rate, or other fund or rate applicable to the general purposes of the Public Health Acts;

(3.) A county council may charge any expenses incurred by them under this Act on any part of their county for the requirements of which such expenses have been incurrred.

(4.) A local authority may borrow for the purposes of this Act—

(*a*.) In the case of a county council, in manner provided by the Local Government Act, 1888: 51 & 52 Vict. c. 41.

(*b*.) In the case of a borough council, as if the purposes of this Act were purposes for which they are authorised by section one hundred and six of the Municipal Corporations Act, 1882, to borrow: 45 & 46 Vict. c. 50.

(*c*.) In the case of an urban sanitary authority not being a borough council, as if the purposes of this Act were purposes for which they are authorised to borrow under the Public Health Acts.

Audit of accounts of aided schools.

5. Where the managers of a school or institution receive aid from a local authority in pursuance of this Act, they shall render to the local authority such accounts relating to the application of the money granted in aid, and those accounts shall be verified and audited in such manner as the local authority may require, and the managers shall be personally liable to refund to the local authority any money granted under this Act, and not shown to be properly applied for the purposes for which it was granted.

Audit of accounts of urban sanitary authority.

6. The accounts of the receipts and expenditure of an urban sanitary authority under this Act shall be audited in like manner and with the like incidents and consequences, as the accounts of their receipts and expenditure under the Public Health Act, 1875.

7. In the application of this Act to Ireland—

Application of the Act to Ireland. 41 & 42 Vict. c. 52.

(1.) The expression "local authority" shall mean the urban or rural sanitary authority, as the case may be, within the meaning of the Public Health (Ireland) Act, 1878.

(2.) The local rate for the purposes of this Act shall be—

(*a*.) in the case of an urban sanitary authority, the rate or fund applicable to the expenses incurred or payable by such authority in the execution of the Public Health (Ireland) Act, 1878, under the provisions of the said Act;

(*b.*) in the case of a rural sanitary authority, the rate or rates out of which special expenses incurred in respect of any contributory place or places are payable under the provisions of the said Act.

(3.) A local authority may borrow for the purposes of this Act as if the purposes of this Act were purposes for which the sanitary authority are authorised to borrow under the Public Health (Ireland) Act, 1878.

(4.) Any reference to the Public Health (Ireland) Act, 1878.

Meaning of technical and manual instruction.

8. In this Act—

The expression "technical instruction" shall mean instruction in the principles of science and art applicable to industries, and in the application of special branches of science and art to specific industries or employments. It shall not include teaching the practice of any trade or industry or employment, but, save as aforesaid, shall include instruction in the branches of science and art with respect to which grants are for the time being made by the Department of Science and Art, and any other form of instruction (including modern languages and commercial and agricultural subjects), which may for the time being be sanctioned by that Department by a minute laid before Parliament and made on the representation of a local authority that such a form of instruction is required by the circumstances of its district.

The expression "manual instruction" shall mean instruction in the use of tools, processes of agriculture, and modelling in clay, wood, or other material.

Extent of Act.

9. This Act shall not extend to Scotland.

Short title.

10. This Act may be cited as the Technical Instruction Act, 1889.

TECHNICAL INSTRUCTION ACT, 1891.

54 & 55 Vict., Chapter 4.

An Act to amend the Law relating to Technical Instruction.

[26th March 1891.]

BE it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

Explanation of powers of local authority as to technical instruction. 52 & 53 Vict. c. 76.

1.—(1.) Subject to the conditions and restrictions contained in the Technical Instruction Act, 1889, a local authority may—

(*a.*) Make such provision in aid of the technical or manual instruction for the time being supplied in a school or institution outside its district as may, in the opinion of the authority, be necessary for the requirements of the district in cases where similar provision cannot be so advantageously made by aiding a school or institution within its district; and

(*b.*) Provide or assist in providing scholarships for or pay or assist in paying the fees of students ordinarily resident in the district of the local authority at schools or institutions within or outside that district.

(2.) In distributing the provision made in aid of technical or manual instruction, the local authority may consider all the circumstances of the case, and shall not be bound to distribute the provision so made exclusively in proportion to the nature and amount of efficient technical or manual instruction supplied by those schools or institutions respectively.

Application of balances. 53 & 54 Vict. c. 60.

2. Any moneys received by a county council under sub-section (1) (*b*) of section one of the Local Taxation (Customs and Excise) Act, 1890, and directed by resolution of the county council to be appropriated or to be set aside for the purposes of technical or manual instruction, shall, although not expended or specifically contributed or allotted in whole or in part before the end of the financial year, remain applicable for such purposes, and shall not be applied in manner provided by sub-section (2) and the following sub-sections of section twenty-three of the Local Government Act, 1888, until the county council shall have made an order for such application.

51 & 52 Vict. c. 41.

Where a council shall have referred to a committee the question of appropriating to purposes of technical or manual instruction any sum consisting of the whole or any part of such moneys, this section, unless and until the council otherwise direct, shall, until the committee shall have made their report and the council shall have arrived at a decision thereon or the appointment of the committee shall have been rescinded, apply to such sum as if the same had been directed by the council to be appropriated to such purposes.

Construction of 53 & 54 Vict. c. 60. s. 1.

3. The expression "technical education" in section one of the Local Taxation (Customs and Excise) Act, 1890, shall be deemed to include both technical and manual instruction within the meaning of the Technical Instruction Acts, 1889 and 1891.

Short title and construction.

4. This Act may be cited as the Technical Instruction Act, 1891, and shall be construed as one with the Technical Instruction Act, 1889, and this Act and the Technical Instruction Act, 1889, may be cited together as the Technical Instruction Acts, 1889 and 1891.

See also—
Local Taxation (Customs and Excise) Act, 1890, 53 & 54 Vict. ch. 60.
Technical and Industrial Institutions Act, 1892, 55 & 56 Vict. ch. 29.
Schools for Science and Art Act, 1891, 54 & 55 Vict. ch. 61.
Technical Schools (Scotland) Act, 1887, 50 & 51 Vict. ch. 64.
Technical Instruction Amendment (Scotland) Act, 1892, 55 & 56 Vict. ch. 63.
Public Libraries Act, 1892, 55 & 56 Vict. ch. 53.
Public Libraries Consolidation (Scotland) Act, 1887, 50 & 51 Vict. ch. 42.

APPENDIX B.

FORMS SPECIAL TO SCIENCE.

Form 802B.
S.

CIRCULATION of APPARATUS and OBJECTS for the INSTRUCTION OF SCIENCE CLASSES.

The Lords of the Committee of Council on Education, with a view to the more efficient instruction of Science schools, have caused suitable collections of apparatus to be formed specially adapted for the illustration of Science teaching. These collections are exhibited in the South Kensington Museum, and are illustrative of the following Science subjects:—

Machine Construction.
Building Construction.
Naval Architecture.
Theoretical Mechanics.
Sound, Light and Heat.
Magnetism and Electricity.
Chemistry.
Geology.
Human Physiology.
Botany.
Navigation.
Steam.
Physiography (Parts I. and II.).
Principles of Agriculture.

My Lords have also caused duplicate sets of the above apparatus to be formed, and will be prepared to entertain applications from Science schools for lending them for a short period. They are lent in order that teachers may have an opportunity of examining and trying the apparatus, and be enabled to make a selection for purchase of that apparatus which would be most useful for instruction.

The following are the conditions on which loans will be granted:—

1. Applications for the loan of Science apparatus to be made by the Local Committee through their Secretary, the Committee to be responsible for the security and safe return of the objects lent.

2. Applications for loan of Science Collections during any year must be made on or before the 1st October of each year (*see* Form No. 802), and the Committee must be prepared to furnish full information as to the nature of the buildings in which the apparatus will be deposited, and what provision will be made for its safe custody and protection.

3. No set of apparatus will be allowed to remain on loan in any Science school for a longer period than three weeks.

4. Teachers will be allowed to use the apparatus for the purpose of demonstrating before their classes; but they must not be used by the students, and any damage which the apparatus may sustain whilst in the possession of the class will have to be made good at the expense of the Committee.

5. The cost of carriage of the collection to and fro will be defrayed by the Department.

Upon the receipt of the apparatus from the Department the Secretary of the Local Committee must immediately report the condition in which it is received, and specially notify any damage or injury. The Committee will be held responsible for the apparatus being safely repacked, and will be accountable for any damage which the collection may receive from the time of its receipt by them until its return to the Department.

Form 1284.
S.

APPARATUS, ETC. CONSIDERED BY THE DEPARTMENT TO BE INDISPENSABLE FOR THE EFFICIENT TEACHING OF THE FOLLOWING SUBJECTS OF SCIENCE.

Subject I.—Practical Plane and Solid Geometry.

Cone with three sections. Model showing the projections, traces, and intersections of lines. Wire or other model of a triangular prism. Wire or other model of a square prism. Wire or other model of a hexagonal prism. Wire or other model of a cube. Wire or other model of a square pyramid. Wire or other model of a cylinder. Wire or other model of a cone. Drawing board and T square. Blackboard.

Subject II.—Machine Construction and Drawing.

Set of diagrams of machine details, mounted.

Subject VI.—Theoretical Mechanics.

Division I.

Lever; pulleys, set of simple; compound pulleys; wheel and axle. (These can be obtained to mount on a blackboard with suspension rail and hooks.) Screw. Pendulum, simple, with three balls. Pendulum, compound. Spring balance. Working models of inclined plane and wedge.

Division II.

Balance, with accessories for determining the specific gravity of an insoluble solid, whether heavier or lighter than water, and for determining the specific gravity of a liquid by comparing the weights of equal measured volumes of the liquid and water, or by comparing the weights of a glass ball in water and in the liquid. Specimens of floating bodies to show the position of stable equilibrium in different cases, *e.g.*, cylinders of wood or cork, some floating with the axis horizontal and some with the axis vertical, and with different degrees of stability. Air pump, with mercurial gauge. Glass tube closed at one end, and mercury for illustrating the pressure of the atmosphere, and of the vapours of different liquids. Syphon. Model of suction pump in which the action of the valves can be seen.

Subject VII.—Applied Mechanics.

In addition to the apparatus in the above list for Subject VI., the following:—Heart-shaped cam in action between two friction rollers upon one oscillating bar and producing equable motion in both directions. The curves are involutes of the circle. Eccentric pin and slit bar with discs to produce rotatory or oscillatory motions by sliding contact. The quick return motion as used in Whitworth's shaping machine, and other tools, all the motion parts being shown. Folding diagram in cardboard, to show the principle upon which guide pulleys are arranged to convey an endless band from one wheel to another when their axes are not parallel. Rod reciprocating by means of an eccentric pin and link arranged so as to show the variations of its motion which arise from different lengths of links, and also to exhibit "Booth's Motion."

Elementary Physics.

An alternative for the first or elementary stage of Subjects VIII. and IX.

Sound.

Tuning fork. Rod about ¾ in. diameter and not less than 4 ft. long. Deal sounding board. Wooden trough with glass front (to show wave motion). Caoutchouc tube about ¼ in. wide and 12 ft. long, filled with sand. Two turned iron tubes about 3 ft. long and 4 in. in diameter, with supports. Humming top, fitted with iron plate pierced with two rows of holes and with tooth edge. Monochord, and set of weights, with 2 sets of brass and steel wires.

Light.

Gas jet, with pin-hole opening. Pin-hole camera. Wire pyramid, to illustrate law of inverse squares. Apparatus to illustrate the law of reflection. Concave glass mirror. Convex lens. Newton's colour disc, with spinning top. Glass prism.

Heat.

Thermometer. Unequal-expansion bar. Apparatus to show the unequal expansion of different liquids. Simple air thermometer. Differential thermometer. Set of cylinders, copper, tin, lead, iron, zinc, bismuth, cork, wood, for specific heats. Thermometer tubes. Brass tube.

Magnetism.

Bar magnet. Knitting needles to magnetize. Bar of soft iron. Magnetic needle on vertical pivot. Iron and steel filings.

Electricity.

Glass tube. Flannel and silk rubbers. Sticks of shellac and sealing wax. Amalgam. Electroscope. Electrical machine. Insulated conducting balls.

Grove's or Bunsen's battery, 4 cells at least. Strips of copper and zinc. Cotton-covered wire. Electrolysis of water apparatus. Electric bell.

Subject VIII.—Sound, Light, and Heat.

Sound (Elementary Stage).

Air pump. Alarum. Caoutchouc tube, about ¼ inch wide and 12 feet long, filled with sand. Wooden trough with glass front; round trough (to show wave motion). Tuning fork. Rod, about ¾ inch diameter and not less than 4 feet long. Deal sounding board. Simple pendulum. Humming top, fitted with iron plate pierced with two rows of holes, and with tooth edge. 2 tinned tubes; pinhole gas-burner for sensitive flame; batswing burner (to show reflection of sound).

Sound (Advanced Stage).

Boyle's tube. Fire syringe. 2 tuning forks in unison. 1 tuning fork an octave higher. Iron table vice with cork-lined clamp. Square glass (or brass) plate for ditto. Violin bow. Monochord, and set of weights, with two sets of brass and steel wires. Deal and oak rods, each 6 ft. long by ½ in. Deal and oak rods, each 3 ft. long by ½ in. Glass tube, 3 ft. long by ½ in. 2 long measuring glasses to be tuned by water to resonate to the forks. Gas jet with small orifice and glass tubes for singing flames. Galton's whistle. Small mirrors to attach to tuning forks for Lissajous' figures and beats. Lantern.

Light (Elementary Stage).

Gas jet. Pinhole camera. Wire pyramid to illustrate law of inverse squares. Mirror turning about vertical axis, wooden arm and graduated paper for law of reflection. Two glass mirrors to be put at different angles for reflection. Two concave mirrors. Convex lens. Glass trough, with divisions, to show refraction. Two flat glass cells. Glass prism. Trough with lens to measure index of refraction. Lantern.

Light (Advanced Stage).

Model of goniometer, or spectroscope. Polished metal semi-circle mounted on wood painted white for caustics. Convex mirror. Glass trough to show critical angle. Set of lenses. Prisms of flint and crown glass. Carbon bisulphide prism. Selected concave and convex spectacle glasses to show Newton's rings. Rings, &c. to form soap films. Wooden model to illustrate Fresnel's interference bands. Simple polariscope. Differential air thermometer, with one bulb blackened to show heat due to absorption. Photographic printing frame, with two pieces of blue and red glass to expose. Glasses of different colours to show absorption. Coloured bodies to place in different parts of the spectrum. Phosphorescence tube. Wood painted with luminous paint. Colour disc. Wool test for colour blindness. Lantern.

Heat (Elementary Stage).

Cryophorus. Water hammer. Differential thermometer. Thermometer. Unequal expansion bar. Contraction apparatus, with bars. Metal bar and gauge to show expansion, or s'Gravesande's ring. Concave tin reflectors (2). Set of iron balls, with stand, for radiation experiments. Copper ball, with ring handle. Set of cylinders, copper, tin, lead, iron, zinc, bismuth, cork, wood, for specific heats. Leslie's cube. Thermometer tubes. Barometer tubes.

Heat (Advanced Stage).

Glass bulb and tube filled with coloured water, to show expansion of glass when suddenly heated. Lead and hammer to show production of heat. Thermopile and galvanometer. Metal rod with small air thermometers attached to show curve for measurement of conductivity. Steel mortar and close fitting pestle to make cylinders of ice. Wet and dry bulb thermometers. Blackened tin vessel for freezing mixture to show deposition of dew. Bright metal dish for spheroidal state. Small compression pump and and reservoir. Lantern.

Subject IX.—Magnetism and Electricity.

Magnetism.

(*a*)Piece of magnetic iron ore. (*a*)Magnetic needle on vertical pivot. Dipping needle. Pair of bar magnets. (*a*)Horseshoe magnet. (*a*)Iron and steel filings. Pieces of soft iron. (*a*)Knitting needles to magnetize. (*a*)Compass card.

Frictional Electricity.

(*a*)Electrical glass tube. (*a*)Fur and silk rubbers. (*a*)Stick of shellac. (*a*)Stick of sulphur. (*a*)Stick of sealing wax. Brass tube or rod with rounded ends. Electrical machine, plate or cylinder. Amalgam, (*a*)Electroscope. Leyden jars. Leyden jar with moveable coating. Discharger. Sheet of caoutchouc. (*a*)Electrophorus. Pith ball electrometer. (*a*)Insulating stand. 2 conductors, cone, cylinder, and balls, to fit on stand. Roll of tinfoil on glass tube. Fulminating pane. Electric whirl.

(*a*) *See* under Subject XXIII.

Voltaic Electricity.

Strips of copper and zinc. Daniell's cell. Smee's cell. Grove's or Bunsen's battery, 4 or more cells. Copper wire, covered with cotton. Copper wire, covered with silk. Copper wire, covered with gutta-percha. Oersted's experiment. Electro-magnet. Pair of flat spirals on boards. Galvanometer. Model of single needle telegraph. Induction coil. Mercury, 2 lb. Electrolysis of water apparatus.

Subject X.—Inorganic Chemistry.

Spirit lamp. (*b*)Bunsen burner, rose and blowpipe jet. Bunsen burner with spreading flame. (*c*)Mouth blowpipe. Crucible tongs. (*b*)Platinum foil and wire. Iron spoons. (*b*)Retort stands, each with a clamp and three rings, 2. Iron tripod. (*b*)Sand bath. (*b*)Wire gauze, 2 pieces. Pipeclay triangle. Test tube brush. Spatula. Triangular file in handle. Round file in handle. (*b*)Cork borers, set of 6, and an iron rod. Clips, 1 spring and 1 screw. India-rubber tubing, 4 pieces, namely:—6 feet of $\frac{5}{16}$ inch; 3 feet of $\frac{1}{4}$ inch; 3 feet of $\frac{5}{16}$ inch; 3 feet of $\frac{1}{8}$ inch. India-rubber stoppers, 30, namely:—1 of $1\frac{1}{4}$ inch; 1 of 1 inch; 3 of $\frac{7}{8}$ inch; 3 of $\frac{3}{4}$ inch; 8 of $\frac{5}{8}$ inch; 4 of $\frac{1}{2}$ inch; 2 of $\frac{3}{8}$ inch, all having one hole; also 2 of $\frac{1}{4}$ inch; 3 of $\frac{3}{4}$ inch; 3 of $\frac{5}{8}$ inch, all having two holes. (*b*)Pneumatic trough. Deflagrating spoon. Mortar and pestle. (*b*)China basins, 2. China plates, 2. Porcelain crucible and lid. (*b*)Porcelain evaporating basin. Glass rod, 1 specimen. Glass tubing, of potash glass and of soda glass, 18 specimens. Glass bulb with long neck. Glass tube with bulb for reduction experiments. Calcium chloride tube. U-tubes, 2. Tumblers, 2. Aspirator. Glass crystallising dish. Gas jars, 3. Stoppered bottles, wide-mouthed, for gases, 5. (*b*)Bell jar stoppered). Ground glass plates, 1 of 5 inches; 3 of $3\frac{1}{2}$ inches; 2 of 3 inches. Soda water bottle. Funnel. Filter papers, 1 packet of $5\frac{1}{2}$ inches, and 1 packet of $4\frac{1}{2}$ inches. Thistle funnels, 2. (*b*)Flasks, 2 of 24 oz.; 3 of 16 oz.; 3 of 8 oz. Beakers (lipped), nest of 4. Clock glasses, 1 of 4 inches and 1 of $3\frac{1}{2}$ inches. Watch glasses, 1 of 3 inches and 1 of $2\frac{3}{4}$ inches. (*b*)Test tube stand with holes and pegs for 12 tubes. Boiling tubes, 4 of 7 inches by 1 inch. (*b*)Test tubes, 12 of 6 inches by $\frac{3}{4}$ inch Retorts 1 of 16 oz., stoppered; 1 of 8 oz., unstoppered; 1 of 4 oz., unstoppered. Apothecaries' scales and 17 weights, namely:—2 oz.; 1 oz.; $\frac{1}{2}$ oz.; $\frac{1}{4}$ oz.; 2 drachms; 1 drachm; 2 scruples; $1\frac{1}{2}$ scruples; 1 scruple; $\frac{1}{2}$ scruple; 6 grains; 5 grains; 4 grains; 3 grains; 2 grains; 1 grain; $\frac{1}{2}$ grain; in a box. Stand for suspending the scales. Measures and weights of the metric system, namely:—1 metre; 1 cubic decimetre; 1 cubic centimetre; 1 kilogram; 1 hectogram; 1 decagram; 1 gram; 1 decigram; 1 centigram; 1 milligram. Grove's battery, 5 cells; with two conducting wires. Ruhmkorff's coil; with two conducting wires. Apparatus to show that there is no destruction of matter when a candle burns. Apparatus for burning air in an atmosphere of coal gas. Globular flask fitted for showing that air has weight. Horseshoe magnet and tin tray to suspend from the beam of the scales. Apparatus for the electrolysis of water and of hydrochloric acid; with stand and pair of platinum poles and of carbon poles. Apparatus for generating ozone. Blocks to illustrate combination in multiple proportions, 8. Apparatus for preparing nitric peroxide from air. Clay tobacco pipe with long stem.

[In the Alternative Elementary Stage of Inorganic Chemistry, it will suffice if the apparatus required to perform the experiments detailed in the syllabus is provided.]

(*b*) *See* under Subjects XIV., XXIII., and XXIV.
(*c*) *See* under Subjects XXIII. and XXIV.

Subject XI.—Organic Chemistry.

Subject X*p*.—Practical Inorganic Chemistry.

Subject XI*p*.—Practical Organic Chemistry.

A list of the indispensable apparatus is given in the syllabus.

Subject XII.—Geology.

Geological map of the British Isles. Geological map (1 inch) of the district. Geological horizontal sections of the district. Typical collection of fossils.

Subject XIV.—Human Physiology.

An articulated skeleton, or a set of bones of upper and lower extremities and ribs. Diagram of the organs of circulation and respiration. Compound microscope. Dissecting instruments. Apparatus for simple experiments in chemistry. The articles required are marked (*b*) under the head of Subject X.

Subject XVII.—Botany.

Microscope, compound. Microscope, simple. Set of botanical diagrams.

Subject XIX*p*.—Practical Metallurgy.

A list of the indispensable apparatus is given in the Syllabus.

Subject XXII.—Steam.

Mariotte's apparatus to illustrate Boyle's Law. Apparatus for experiments on latent heat of steam. Model of parallel motion with pantograph. N.B.—If this is not procurable, it may be replaced by the following (one or two varieties showing form in common use):—Parallel motion, five varieties: Beam engine; marine engine; small steam engine (a); Watt's engine; small steam engine (b) Working model of beam engine; sectional model of locomotive engine. (These are very desirable, but if good diagrams be used, they will not be looked upon as indispensable.) Reversing gear.

Subject XXIII.—Physiography.

Maximum, minimum, and black bulb thermometers. Barometer. Rain gauge, simple. Ordnance survey map of district, showing contour lines. Terrestrial globe, not less than 12 in. diameter. Geological map of the British Isles. Apparatus for simple experiments in magnetism, electricity, and chemistry. The articles required are marked (*a*), (*b*), and (*c*) under the heads of Subjects IX. and X.

N.B.—A cheap telescope and a spectroscope are very desirable.

Subject XXIV.—Principles of Agriculture.

Apparatus for simple experiments in chemistry. The articles required are marked (*b*) and (*c*) under the head of Subject X.

Subject XXV.—Hygiene.

In addition to apparatus for the illustration of Elementary Human Physiology classes should be provided with the following :—

Diagram showing classification of potable waters (Rivers Pollution Commission). Diagram showing permeable and impermeable strata, with shallow and deep wells in them. Diagram showing illustrations of water sediment. Diagram showing composition of inspired and expired air. Diagram showing action of Galton's grate with a ventilating shaft. Diagram showing method of ventilating the Houses of Parliament. Model of Ellison's air brick. Model of Sherringham's valve. Model of Tobin's tube. Diagrams showing various forms of traps. Model of a gully trap with movable bucket. (Example of a good trap.) Model of a common mason's or dip trap. (Example of a bad trap.) Models of junction pipes, curved or oblique. (Models of these can be had well glazed on inside.) Diagram showing a disconnecting manhole. Diagram showing a wash-down water-closet pan. (Good form.) Diagram showing old pan closet with metal container and D trap. (Bad form.) Diagram showing good and bad system of drainage for a cottage dwelling. Samples or models of water pipes. (*a.*) Block tin, (*b.*) Iron, (*c.*) Glazed iron. Diagram showing classification of food stuffs into their proximate elements. Diagram showing standard diets. (*a.*) Rest or sustenance, (*b*) ordinary work, (*c*) hard work. Diagram showing per-centage composition of common foods. Diagram showing classification of soils in order of healthiness. Diagram showing types of weather. (*a.*) Cyclones, (*b*) anti-cyclones, (*c*) V-shaped depressions, (*d*) wedges. Model of a barometer scale with vernier. Wet and dry bulb thermometers.

Form 91.
S.

RULES AND REGULATIONS FOR LOCAL SCIENCE EXAMINATIONS, APRIL, MAY, AND JUNE, 1894.

(The Rules for the Examinations in Irish Schools are contained in Form No. 91*b*; in Practical Chemistry in Forms Nos. 91*d*, 91*e*, and 91*f*; and in Practical Metallurgy in Form No. 91*m*.)

N.B.—No one has any authority to modify the following rules in any particular.

I.—RULES.

Directions to Superintendents of Examinations.

1. The examinations must be conducted by Superintendents, who must be either members of Approved Committees or Special Local Secretaries and their Assistants. *Who may act as Superintendents.*

2. Two Superintendents must be present in each room throughout the examination. Where there are more than fifty, but not more than one hundred, candidates in any room three Superintendents will be required in that room, and an additional Superintendent for every additional fifty, or fraction of fifty, candidates. In the case of an L or T-shaped room three Superintendents at least must be present even though the number of candidates in the room should be less than fifty. *Number of Superintendents required in each room.*

3. Superintendents may relieve one another, provided that the required number be always present. If the prescribed number of Superintendents be not present during the whole time of the examination it will be disallowed. *Superintendents may relieve each other.*

4. When a Special Local Secretary's Assistants act as Superintendents (*see* § XXIII. of the Directory), members of the Committee do not conduct the examination, but some of them should attend for a time on each evening that their school is examined to identify their own students. *Attendance of Committee to identify students.*

5. When the examinations are conducted by a Special Local Secretary and his Assistants, each Committee must see that the examination of their class does not fail from accidental circumstances; in case of the unavoidable absence of the Special Local Secretary, or his assistant, a member of the Committee should take his place. *Members of Committee supplying place of Special Local Secretary or Assistant.*

6. Only candidates, superintendents, members of the local committees, and officers of the Department may be present at any examination. *Who allowed to be present.*

Arrangement of Examination Room.

7. Candidates must be seated so as to be *not less than 5 feet apart from each other from centre to centre.* The Superintendents must provide ink, pens, ruled foolscap-paper, and pins or paper fasteners. All diagrams, &c. having reference to the subjects of the examination must be removed from the walls of *Allotting seats.* *Diagrams to be removed.*

the examination room. The examinations in Subjects I., II., III., and IV., should as far as possible be held in rooms with level floors, *i.e.*, without galleries. The General Register (Form No. 486) of each school under examination must be in the room. This register contains the autograph signature of each candidate, and, in the event of any question arising as to the identity of any candidate, his signature on his examination paper slip should be compared with his signature in the general register of his school.

General register required.

Completion of arrangements.

8. All these arrangements must be completed by 6.30 p.m. (*on the 28th April and 5th May by 5.30 p.m.*).

Admission of Candidates.

Admitting candidates.

9. The number of candidates admitted must not be in excess of the number of papers of questions for which due application has been made in accordance with the rules of the Directory. All the candidates must be seated by 6.50 p.m.; no one may be admitted afterwards, except under VERY EXCEPTIONAL CIRCUMSTANCES, and then *only* if no person who has seen the examination paper has left the room. No candidate must on any account be admitted after 7.30 p.m. (*On the 28th April and 5th May, these times will be 5.50 p.m. and 6.30 p.m. respectively.*)

If a candidate is admitted after the time fixed for the commencement of the examination, his name, the time of his arrival, and the exceptional circumstances under which he was admitted, must be stated on the certificate. (*See* page 131.)

Teachers assisting in arrangements.

10. The Superintendents may permit the teacher of the class to assist in getting the candidates into their places, and in seeing that they fill up the forms on the outside of their blank papers (*see* section 11). *He must, however, leave the room before the envelopes containing the examination questions are opened; his presence during any part of an examination, at which he it not himself examined, will involve the cancelling of such examination.* He should not be in or near the building where the examination is held while it is being conducted, unless he wish to be examined, in which case he must apply specially to the Superintendents to provide him with a table apart from the other candidates. Candidates may not bring anything into the examination room, except pens, india-rubber, and pencils, and such articles as are specified on the Time Table (Form No. 90). All books, note-books, &c., must be given up to the Superintendents before the examination questions are distributed.

Examination of Teacher.

No books, &c. allowed.

Distribution of Numbered Forms.

Distribution of blank papers.

11. The blank forms supplied for the candidates to write their answers upon should be first distributed, and the Superintendents should see that the candidates commence by filling in their names, &c. where directed. The arrangement of the candidates and the distribution of the blank papers should be completed before 6.50 p.m. (*on the 28th April and 5th May before 5.50 p.m.*), and should no candidate present himself for examination, or if for any other reason the packet of examination questions is not required, it must be returned to the Department by the next post **unopened.**

Returning packet of questions if no examination held.

12. One of the numbered forms supplied by the Department is to be served out to each candidate to write his answers upon (which must be written in ink, except that in the case of Subjects I., II., III., and IV., the drawings may be done in pencil); when he has filled the whole of this form, he may be supplied with blank foolscap; this should be fastened to the form which the candidate has already filled up, by a Superintendent, who should take care to mark it at the top with the same number as on that form. In Subjects I., II., III., and IV., no more than *one* numbered sheet of drawing paper is to be given to each candidate, but this may be supplemented by as much blank foolscap as the candidate requires, the foolscap being marked as above mentioned; to candidates in Honours of these subjects a piece of clean blotting paper may also be supplied, which, however, must be returned with the worked paper.

Additional foolscap paper allowed.

Use of drawing and foolscap paper.

Conduct of the Examination.

13. At 6.50 p.m. (*on the 28th April and 5th May at 5.50 p.m.*) the regulations on page 130 are to be read to the candidates. — Reading regulations.

14. At 6.55 p.m. (*on the 28th April and 5th May at 5.55 p.m.*) each packet of examination questions must be carefully examined by each Superintendent before it is opened, and he must ascertain that it has not been tampered with. The packets must then be opened in the examination room. *Under no circumstances whatever may a packet of examination questions be opened when one Superintendent only is present; such a course alone suffices to annul the examination.* At 7 p.m. (*on the 28th April and 5th May at 6 p.m.*) the examination questions must be distributed, and on those evenings on which there are two or more subjects of examination, special care must be taken that no student has a paper of questions in more than one subject. *No paper of questions may be given to any candidate until he has filled up the slip attached to his numbered form, and this numbered form, with slip attached, must be returned to the Department even if the candidate does no work on it.* No paper of questions may on any pretext be taken from the room until every candidate shall have completed and given up his worked paper. — Examining and opening packets of questions. — Only one paper of questions allowed.

15. The Superintendents must give their whole attention to the examination and must carefully watch to see that candidates use no unfair means, either by assisting one another, by using books or notes, or otherwise. They are also requested not to talk unnecessarily, as it tends to disturb the candidates, nor should observations be made on the candidates' work. It is advisable that Superintendents should not remain seated in one place during the examination, and one of them should as often as possible place himself *behind* the candidates. — Vigilant and silent supervision necessary.

16. At 10 p.m. (*on the 9th May at 10.30 p.m.*), or as much sooner as all the candidates have completed their papers, the worked papers must be collected. Before he takes a paper from a candidate a Superintendent must see that the slip is properly filled up and then initial it in order to prevent personation; he must be careful not to treat this duty as a mere matter of form. A candidate who has given up his paper must at once leave the room. — Collecting and initialing worked papers.

17. The worked papers, together with the certificate on page 131 duly filled up, must be fastened up in the canvas bag supplied by the Department for that purpose *in the presence of at least two Superintendents.* When an examination is held in more than one subject on the same evening at the same centre, the worked papers for each subject should be fastened up in a separate bag. Before the bag is thus made up no person who is not a Superintendent must enter the room. Should the examination have commenced late, no allowance can be made, but the papers *must be collected punctually at 10 p.m.* (*on the 9th May at 10.30 p.m.*). FAILURE TO COLLECT THE PAPERS AT THE PRESCRIBED TIME WILL, IN ALL CASES, ANNUL THE EXAMINATION. No extension of the time of collection can be granted by any one. — Fastening up the worked papers' bag.

18. At the conclusion of each examination it will be the duty of some one of the Superintendents to post the parcel of worked papers, at the nearest district or branch post office, and this duty must not be deputed to any other person. If unable to post the parcel overnight, it should be kept in safe custody, and posted at the nearest post office by the first post next morning. — Posting the papers.

II.—Regulations.

To be read to the Candidates on each evening before the packets of Examination Questions are opened.

1. Before commencing your work you are required to fill up the printed form which is attached to the blank examination paper.

2. You may not have with you any books, notes, or scribbling paper.

3. You are not allowed to write or make any marks on your paper of questions, or to take it away before the close of the examination.

4. You must not, under any circumstances whatever, speak to or communicate with one another, and no explanation of the examination paper may be asked or given.

5. You must remain seated until your paper has been collected, and then quietly leave the examination room. But none of you will be allowed to leave before the expiration of one hour from the commencement of the examination.*

6. Your papers unless previously given up, will all be collected at 10 o'clock.†

7. If any of you use unfair means, or break any of these rules, you will be expelled, and your paper cancelled.

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* *As no candidate can be permitted to return after having once left the examination room, the Department, to obviate the hardship which might be entailed, will not object to an arrangement to enable candidates to retire within the examination room.*

† On the 9th May read 10.30 o'clock.

For the certificate to be signed by the Superintendents of the Examination see next page.

III.—Certificate by the Superintendents of Examination.

To be filled in and signed by the Superintendents, and forwarded with each set of worked papers.

We, the undersigned Superintendents of the Science Examinations held at [1]_____ hereby certify that we were present during the examination in [2]_____ on the evening of the [3]_____ when [4]_____ candidates presented themselves; that the seal(s) of the [5]_____ envelope(s) containing the examination questions (was/were) broken at [6]____p.m.; that the accompanying papers were worked in our presence, and all collected by [7]_____p.m., and fastened up in the bag in the presence of at least two Superintendents, and that the foregoing rules and regulations, as far as they applied during our presence, have been strictly complied with.

Dated this_____day of _____ 189 .

[1] Name of building and town.
[2] state subject.
[3] Date
[4] Number.
[5] State number of envelopes opened.
[6] and [7] Exact time.

Note.—A separate certificate is required to be filled up for each examination room should more than one be used. Every person—other than the Candidates and the Officers of the Department—who is present *at any time* during the Examination, should sign the above certificate. Should a Superintendent leave the examination room and return to it, the time of his first arrival and departure, and of his second arrival and departure, should be exactly stated.

Exactness in filling up this certificate will obviate correspondence and delay in the issue of results. The slightest deviation from the letter of the foregoing rules must be reported.

Signatures.	State whether a Special Local Secretary, a Special Local Secretary's Assistant, or a member of the Committee.	If a Member of Committee, state School No.	Time Present.			
			Hour of Arrival.		Hour of Departure.	
			H.	M.	H.	M.

Admission of Late Candidates.

(See § 9 on p. .)

Names of Candidates admitted Late.	Time when admitted.		Reasons for Lateness.
	H.	M.	

Certificate of Closing of Bag.

(See § 17 at p. .)

To be signed by the Superintendents present at the close of the Examination.

The worked papers have been all placed in the bag, which is now about to be closed at (Insert time) H. _____ M. _____ p.m. in the presence of

CLAIM FOR PAYMENTS ON RESULTS OF EXAMINATIONS, 1894. (SCIENCE.)

School Number. 5,206.

Form 51. S.

No. of Voucher.

Registry Stamp.

Application for Payment from Mechanics' Institute, [Name of school or institution.]

at Ashton-Carlton [Name of town or village.]

Number of individual students of the above School examined in Science at examinations in April, May, and June 1894.—20.

On behalf of the Committee of this School, We, the undersigned Members, certify:—

(1.) That the following Teacher(s), viz., Messrs. William Brown, John Jones, and Francis Robinson {have / has} duly performed the various duties devolving upon {them / him} as (a) Science Teacher(s) in the School during the year ended May 1893; that {they have / he has} given to the class not less than 28 lessons during the session and before the examination in each subject in which a claim is made; and that each of such lessons was of at least one hour's duration (or if in Practical Chemistry or Practical Metallurgy of at least one and a half hour's duration) and was given on a separate day.

(2.) That each of the individual students claimed upon has received at least 20 lessons of not less than one hour's duration each (or if in Practical Chemistry or Practical Metallurgy of not less than one and a half hour's duration each), during the session (or since the last examination in the subject at which the student was successful), in each subject for which payment on account of the student is claimed; and that all the lessons on which the claim is based have been duly registered and have been given within the two years ended May 1894, and in classes supervised by our Committee.

(3.) That no claim is made on account of any student who is a pupil on the registers of an Elementary School receiving aid from the English or Scotch Education Departments unless such pupil had passed Standard VI. of the English or Scotch Codes respectively, or had been placed altogether in Standard VII. of the English Code prior to being registered as a student

of a Science class; and no claim is made on account of a success in any subject in which the student has been examined, since the 1st August 1892, by the English or Scotch Education Departments for a class or specific subject grant or by the Commissioners of National Education in Ireland for an extra branch fee.

(4.) That no claim is made in Stage 1 of Mathematics on account of any male student who is, or has been, a Pupil Teacher or an Assistant Teacher in a Public Elementary School under the English or Scotch Education Departments, or who has been trained as a teacher at the public expense, *i.e.*, in a State-aided Training College.

(5.) That the students claimed on belong to the classes on whom payments are made according to the rules of the Directory; that is to say, they come within one or more of the following categories, viz.:—

a. Persons in the receipt of weekly wages, and their children not gaining their own livelihood.

b. Teachers and pupil-teachers of elementary schools in connexion with the English or Scotch Education Department, or the Board of National Education, Ireland, and their children, if not gaining their own livelihood. (*See exceptions in* § 26 *at pp.* 34–35, *and the special rules applying to Irish National School teachers at pp.* 56–59 *of the Directory.*)

c. Persons in the receipt of not more than 40*0l.* a year from all sources (*i.e.*, who are allowed an abatement of the income tax), and their children if not gaining their own livelihood.

d. Scholars in public elementary schools within the meaning of the Elementary Education Acts, and scholars who on leaving the elementary school are proceeding with their education in Science or Art Schools or Classes.

e. Students in an organised Science School (see §§ 22–28, at p. 33, *et seq.* of the Directory) under public management, or in a night class for Industrial students which meets after 6 p.m., or on Saturdays after 2 p.m.

(6.) That each of the teachers is duly qualified according to sections 5 and 5*a*, pp. 24-26 of the Directory (revised to June 1894), to earn payments in each of the subjects taught by him.

Examined and certified at a meeting of the Committee held for that purpose at Ashton-Carlton, on the 22nd day of July 1894.

John Richards, Chairman of Meeting.
Alfred H. Dickson.
Walter Harrison.
} Autograph signatures of three approved members of the Local Committee present at the meeting.

The following will be filled up by the Department.

Subhead of Vote D 1.

Pay to _____ £ :

_____ Certifying Officer.

N.B.—The names of the students must be arranged alphabetically, and against each name must be placed—using a separate line for each success—the particulars of the several successes (if more than one) on which a claim is made; and in the last column the payment claimed on each of such successes after making the proper deductions. Only the names of those students, and the particulars of the successes on account of which a claim is made, should be entered hereon.

No claim on account of a success in Stage 1 of Mathematics (V.) can be allowed on account of male students who are or have been Pupil Teachers or Assistant Teachers in Public Elementary Schools under the English or Scotch Education Departments, or who have been trained as teachers at the public expense, *i.e.*, in a State-aided Training College

In claims made under category "c" the statement "Father deceased" will not be accepted as a satisfactory description; it will be necessary in such cases to show the actual status of a fatherless candidate.

Student's No. on General Register.	No. of registered Attendances.	Names of Students claimed on (in strict alphabetical order). Surname.	Christian Name(s) in full.	Age last Birthday.	Category a, b, c, d, or e under which Claim is made	Particulars of Successes claimed on. Success at the late Examination. Subject.	Stage.	Class.	Highest success in same Subject in any previous Examination. Stage	Class.	Payment claimed. £ s.
20	27	Adams -	John James,	15	a.	I.	E. § 1	Pass	—	—	0 10
	24	„ -	„	„	„	V	1	Pass	—	—	2 0
	26	„ -	„	„	„	VI. a.	E.	Pass	—	—	2 0
						X.	A.	2	Alt.	1	2 10
14	25	Carter -	William Henry.	22	c.	X.	A.	1	E.	1	5 0
	20	„ -	„	„	„	X. p.	A.	2	—	—	3 10
3	25	Jones -	Richard	23	a.	I.	E.	Pass	—	—	2 0
	23	„ -	„	„	„	III.	A.	1	A.	2	2 10
18	30	Robinson	Peter Charles.	20	a.	I.	A.	2	E.	2	2 10
	30	„	„	„	„	II.	A.	1	E.	1	5 0
	23	„	„	„	„	XXII.	E.	Pass	—	—	2 0
	26	Smith -	Robert -	16	d.	VI. b.	A.	2	—	—	2 10
	25	„ -	„ -	„	„	VIII.	E.	Pass	—	—	2 0
25	27	„ -	Arthur Hugh.	17	d.	XIV.	E.	Pass	E.	2	1 0
8	30	Thomson	Charles	14	a.	IX.	E.	Pass	—	—	2 0
10	30	„	George -	19	e.	I.	A.	2	E.	1	2 10
	26	„	„ -	„	„	V.	2	2	1	1	2 0
2	22	Thompson.	Henry -	16	e.	II.	A.	2	E.	2	2 10
	24	„	„ -	„	„	VII.	E.	Pass	—	—	2 0
4	30	Watson	William	18	b.	V.	2	1	—	—	3 0
	26	„	„	„	„	X.	A.	2	E.	1	2 10
	26	„	„	„	„	X. p.	E.	Pass	—	—	3 0
7	29	Williams	Charles	21	e.	XI. p.	A.	1	A.	2	2 10
5	23	Young -	Robert -	26	b.	V.	3	1	2	1	4 0
	26	„ -	„ -	„	„	VI. a.	A.	2	E.	1	2 10
	26	„ -	„ -	„	„	VI. b.	E.	Pass	—	—	2 0
	24	„ -	„ -	„	„	XXIII	A.	1	A.	2	2 10
22	30	„ -	Thomas	20	a.	X.	A.	2	E.	1	2 10
	30	„ -	„	„	„	X. p.	A.	1	E.	1	6 0
	22	„ -	„	„	„	XV.	E.	Pass	—	—	2 0
											£76 0

APPENDIX C.

REPRINT *of the* Art Form 965*c*
for May 1894.

RULES AND REGULATIONS FOR LOCAL ART EXAMINATIONS, APRIL, MAY, AND JUNE, 1894.

N.B.—No one has any authority to modify the following rules in any particular; they must be carried out to the letter.

I.—RULES.

DIRECTIONS TO SUPERINTENDENTS OF EXAMINATIONS.

Who may act as Superintendents.

1. The examinations must be conducted by Superintendents, who must be either members of approved Local Committees or Special Local Secretaries and their Assistants. But no persons who have relatives to be examined within their district may act as Superintendents.

Number of Superintendents required.

2. Two Superintendents must be present in each room throughout the examination, except that when there are not more than 15 candidates who can be all accommodated in one room, the examination in any of the following subjects :—2*b*, 3*a*, 3*b*, 5*a*, 5*b*, Drawing the Antique from Casts, Drawing from Life, Painting from Still Life, and Modelling from the Antique and from Life, may be conducted by one Superintendent alone. When there are more than 50, but not more than 100, candidates in any room, three Superintendents will be required in that room, and an additional Superintendent for every additional 50, or fraction of 50, candidates. In the case of an L or T shaped room three Superintendents at least must be present, even though the number of candidates in the room should be less than 50.

Superintendents may relieve each other.

3. Superintendents may relieve one another, provided that the required number be always present. If the prescribed number of Superintendents be not present during the whole time of the examination it will be disallowed.

Attendance of Committee to identify students.

4. When a Special Local Secretary's Assistants act as Superintendents (*see* Science and Art Directory, par. XXII.–V.), members of the Local Committee do not conduct the examination, but some of them should attend for a time on each occasion on which their school is examined to identify their own students.

Member of Committee supplying place of Special Local Secretary or Assistant.

5. When the examinations are conducted by a Special Local Secretary and his Assistants, each Local Committee must see that the examination of their class does not fail from accidental circumstances; and in case of the unavoidable absence of the Special Local Secretary or his Assistant, a Member of the Committee should take his place.

Where there is no Special Local Secretary, a member of the Local Committee, or a Superintendent previously nominated by the Local Committee and approved by the Department, may be appointed to conduct the examination in Painting from Still Life, on 11th May, from 10 a.m. to 4 p.m., and to supervise the Casting from Models (when done during the day time) on the 24th, 26th, and 30th May. He may be paid a fee of half a guinea, one moiety of which must be contributed by the locality. (See § 18, p. 69, of the Science and Art Directory.)

Who allowed be present.

6. Only Candidates, Superintendents, Members of the Local Committees, and officers of the Department of Science and Art may be present at any examination.

ARRANGEMENT OF EXAMINATION ROOM.

Space to be allotted to each candidate

7. Candidates must be so placed as to be not less than five feet apart from each other from centre to centre at the examinations in Anatomy, Principles of Ornament, Perspective, Design, Architecture, Historic Ornament, Drawing the Antique from Memory, Painting in Monochrome, Modelling Design, and

Architectural design. At the examinations in subjects 2*b*, 3*a*, 3*b*, 5*a*, 5*b*, Drawing and Modelling from the Antique, Drawing and Modelling from the Life, and Painting from Still Life, candidates much be placed so as to be not less than two feet six inches apart from each other from centre to centre. The Superintendents must provide ink, pens, tracing paper, ruled foolscap paper, pins or paper fasteners, and necessary materials, such as stands, nails, &c., for hanging up the Casts supplied by the Department for Subjects 3*b*, 5*b* (Elementary and Advanced Stages), and Modelling from the Antique. Each Cast will have its hanging loop. Before the boxes of Casts are opened on each evening Candidates' seats must be arranged opposite the places for hanging up the Casts from which the candidates are to draw. All diagrams, &c., having reference to the subjects of the examination, must be removed from the walls of the examination room, and nothing must be allowed to be within sight of the candidates which may in any way assist them. The General Register (Form No. 486) of each school under examination must be in the room. Superintendents should carefully study and make themselves well acquainted with the confidential and special instructions issued in respect of preliminary arrangements and provisions which have to be carefully made for the Examinations in subjects 3*a*, 3*b*, 5*a*, 5*b*, Drawing from the Antique, Drawing from the Life, Painting in Monochrome, Painting from Still Life, Modelling from Life, Modelling from the Antique, and Modelling Design. The Instructions must be strictly observed.

Diagrams to be removed.

General register required.

Opening of cases containing special canvases or casts.

8. The packages or cases containing the special casts or canvases for the examinations in Subjects 3*b*, 5*b*, Painting in Monochrome, and Modelling from the Antique, must be opened in the examination room not more than one hour before the commencement of the examination in those subjects; the casts must be at once hung up in the appointed places (See 7), and all preliminary arrangements must be completed half an hour before the commencement of the examination on each evening or day.

Teachers assisting in arrangements.

9. The Superintendents may obtain the assistance of the Teacher in the preliminary arrangements for the examinations.

Admission of Candidates.

Admitting Candidates.

10. The number of candidates admitted to each examination must not be in excess of the number for whose examination due application has been made in accordance with the rules of the Directory. Candidates may not bring anything into the examination room except india-rubber and pencils, and such articles as are specified on the Time Table, Form No. 90 (Form No. 90A for Ireland). Candidates for each subject must be in their places 10 minutes before the time prescribed in Form No. 90 (Form No. 90A for Ireland) for the examination to commence. The Superintendents may permit the Teacher to assist in getting the candidates into the places assigned to them by the Superintendents. The Teacher must leave the room before the registered envelope containing the examination questions is opened; his presence during any part of an examination at which he is not himself examined will involve its being cancelled. He should not be in or near the examination room while the examination is going on, unless he is himself a candidate for examination, in which case the Superintendents must provide him with a table apart from the other candidates. All books, note books, &c., must be given up to the Superintendents before the examination questions or examples are distributed.

Examination of Teachers.

No Books, &c., allowed.

11. No one may be admitted after the examination has commenced, except under VERY EXCEPTIONAL CIRCUMSTANCES, and then only if no person who has seen the examination questions has left the room. No candidate must on any account be admitted later than half-an-hour after the commencement of the examination.

If a candidate is admitted after the time fixed for the commencement of the examination, his name, the time of his arrival and the exceptional circumstances under which he was admitted, must be stated on the certificate.—(See page 140.)

Distribution of Numbered Papers.

Distribution of numbered papers.

12. The numbered papers or canvases supplied for the use of the candidates should be first distributed, and the Superintendents should see that the candidates commence by filling in their names, &c., where directed. The distribution of the numbered papers or canvases should be completed ten minutes before the time fixed for the examination to begin. Should no candidate present himself for examination, or if for any other reason the registered envelope of examination questions is not required, it must be returned to the Department by the next post UNOPENED.

Returning packet of questions o examples if no examination held.

Conduct of the Examination.

Opening packets of examination questions or examples.

13. Five minutes before the time fixed for the commencement of the examination in each subject, each registered envelope containing the examination questions must be carefully scrutinized by each Superintendent before it is opened, and he must ascertain that it has not been tampered with. It must then be opened by the Superintendents in the examination room. But under no circumstances whatever may a registered envelope of examination questions be opened when one Superintendent only is present (except as stated in par. 2); such a course alone suffices to annul the examination.

Reading regulations.

THE REGULATIONS PRINTED ON THE EXAMINATION PAPER, OR ON THE PAPER OF SPECIAL INSTRUCTIONS, FOR EACH SUBJECT, MUST BE READ TO THE CANDIDATES IMMEDIATELY BEFORE THE EXAMINATION COMMENCES. The examination questions or examples must then be distributed. No paper of questions or examples may be given to any candidate until he has filled up the slip attached to his drawing paper, foolscap form, or canvas, and the drawing paper, foolscap form, or canvas, with slip attached, must be returned to the Department, even if the candidate does no work on it. No paper of questions or examples may on any pretext be taken from the room until every candidate shall have completed and given up his work.

Principles of Ornament, Perspective, Historic Ornament, Architecture.

14. Each candidate in Principles of Ornament, Perspective, Historic Ornament, and Architecture must be supplied with white foolscap sheets, specially provided, in addition to the numbered drawing paper; and he must write on the foolscap sheet the number printed on his drawing paper, and fasten the foolscap sheet to it.

Principles of Ornament. Design.

15. In the examinations in Principles of Ornament and Design, candidates who ask for them may be provided with pieces of tracing paper; but care should be taken by the Superintendents that no improper use is made of the tracing paper, such as the passing of sketches from one student to another. The candidate must write on the tracing paper the examination number printed on his drawing paper, to which it must be securely fastened and given up.

Vigilant and silent supervision necessary.

16. The Superintendents must give their whole attention to the examination, and must carefully watch to see that candidates use no unfair means, either by assisting one another, by using books or notes, or otherwise. They are also requested not to talk unnecessarily, as it tends to disturb the candidates, nor should observations be made on the candidates' work. It is advisable that Superintendents should not remain seated in one place during the examination, and one of them should as often as possible place himself BEHIND the candidates.

Collecting and initialing worked papers.

17. At the end of the time prescribed for each examination, or as much sooner as all the candidates have completed their papers, &c. the worked papers, &c. must be collected. Before taking a paper, canvas, or cast from a candidate a Superintendent must see that the slip is filled up, and then initial it in order to prevent personation; HE MUST BE CAREFUL NOT TO TREAT THIS DUTY AS A MERE MATTER OF FORM. A candidate who has given up his work must at once leave the room.

Time allowed for working.

18. The time allowed for the examination in each subject must not exceed that stated in Form No. 90 (in Form No. 90A for Ireland). Should the examination have commenced late, no allowance can be made, but the papers,

canvases, or casts, must be collected punctually. FAILURE TO COLLECT THE PAPERS, CANVASES, OR CASTS, AT THE PRESCRIBED TIME, WILL, IN ALL CASES, ANNUL THE EXAMINATION. The exact times of distribution and collection must be carefully entered in the certificate on page 139, a separate Form of Certificate being used for each subject.

Return of worked papers, &c. to Department.

19. At the close of each examination the worked papers, canvases, or casts, together with the certificate, duly filled up and signed, in respect of each subject, must be made up for despatch in the presence of at least two Superintendents (except as stated in par. 2). The canvas bags provided for drawings must be carefully fastened in the manner described in the instructions issued with each bag. When an examination is held in more than one subject on the same evening at the same centre, the worked papers for each subject must be fastened up in a separate bag. Canvases must be packed in the boxes specially provided for them, and care must be taken in packing that the surfaces of the paintings may not touch one another. Casts must be packed in the necessary packing cases and materials provided by the Superintendents.

Posting the papers.

20. BAGS AND PACKAGES CONTAINING THE CANDIDATES' WORK MUST BE DESPATCHED BY THE FIRST POST OR FIRST DELIVERY AFTER THE CLOSE OF EACH EXAMINATION, and it will be the duty of some one of the Superintendents to see to this despatch each evening, or as specially allowed by the rules; and this duty must be performed by a Superintendent, and no other person.

21. AT THE CONCLUSION OF THE LAST EXAMINATION held at a school or centre all the unused material, casts, &c., which have been supplied by the Department must be carefully packed up and returned to the Department.

II.—REGULATIONS.

The Regulations to be read to the Candidates immediately before the Examination in each subject commences are printed on the paper of Examination Questions or confidential Special Instructions issued for each subject.

N.B.—A separate certificate on page 139 must be filled up for each subject, signed by the Superintendents, and forwarded in the bag or case containing the worked papers, canvases, or casts.

FORM OF CERTIFICATE TO BE FILLED IN AND SIGNED BY SUPERINTENDENTS OF LOCAL ART EXAMINATIONS, 1894, AND RETURNED TO THE DEPARTMENT WITH THE WORKED PAPERS, CANVASES, OR CASTS IN EACH SUBJECT.

N.B.—A separate form of Certificate is to be used for each subject of Examination.

We, the undersigned Superintendents of the Art Examination, held at [1] _____ hereby certify that:—

[1] Name of institution and town.

(1) We were present during the Examination in [2] _____ on the [3] _____ day(s) of _____ 1894, when the *accompanying [4] _____ {* papers / canvases} were worked in our presence.

[2] State subject.
[3] State dates.
[4] State number of papers, or canvases.

* Models for the accompanying [5] _____ casts were made, and each candidate cast his own work in our presence.

[5] State number.

(2) The envelope containing the examination *questions or *examples was opened at _____h._____m., on the _____day of_____1894.

(3) *The candidates commenced to *draw or *paint at_____h._____m., and their {* papers / canvases} were collected at_____h._____m.

* The candidates commenced to work at their models at_____h._____m., on the_____day of_____1894, and commenced making casts from their models at_____h._____m., and the casts were collected at _____h._____m., on the _____day of_____1894.

(4) The rules of the Department relative to the Examination in this subject have been strictly complied with.

Dated this_____day of_____1894.

NOTE.—A separate certificate is required to be filled up for each examination room should more than one be used. Every person—other than the candidates under examination and the officers of the Department—who is present *at any time* during the examination, should sign the above certificate. Should a Superintendent leave the examination room and return to it, the time of his first arrival and departure, and of his second arrival and departure, should be exactly stated.

Exactness in filling up this certificate will obviate correspondence and delay in the issue of results. No deviation from the foregoing rules is allowed, but if, from unavoidable circumstances, any deviation should have occurred, it must be reported.

SIGNATURE.	State whether a Member of the Committee, a Special Local Secretary, or an Assistant.	If a Member of Committee, state School Number.	Time present.				Date.
			Hour of Arrival.		Hour of Departure.		
			H.	M.	H.	M.	

* Erase the words that do not apply.

ADMISSION OF LATE CANDIDATES.

NAMES.	Time when admitted.			Reasons for Lateness.
	H.	M.	Date.	

NOTES OF VISITS BY MEMBERS OF LOCAL COMMITTEES.

CLAIM FOR PAYMENTS ON RESULTS OF EXAMINATIONS. (ART) 1894.

N.B.—All payments due to this School or Class on account of Art Examinations, including Art and Science School Works, must be claimed on this one Form.

School Number.

Form 526.
Art.

Application for Payment from _____ [Name of School or Institution.]

at _____ [Name of town or village.]

Number of individual students of the above School of Art, or Art Class, examined in Art in April, May, or June 1894 :— _____ *

* Insert No. of individual students examined in Art.

On behalf of the Committee of Management of this School of Art, or Art Class, We do hereby certify :—

(1.) That the following Teacher(s), viz. :—

†Names _____ Qualifications _____

" _____ " _____

" _____ " _____

† Insert names and qualifications of Teacher(s).

{have / has} duly performed the various duties devolving upon {them / him} as (an) Art Teacher(s) in the School, during the year ended May 1894, and that {they have / he has} given to the class not less than 28 lessons during the session and before the examination in each group of subjects in which a claim is made; each of such lessons being of at least one hour's duration on a separate day.

(2.) That {they have / he has} given each of the students named in this claim at least 20 such lessons, of not less than one hour's duration each lesson, during the session, or since the student's last success in each group of Art subjects in which payment is claimed; all the lessons on which the claim is based have been given during the two years immediately preceding the year of examination, and in classes supervised by our Committee.

(3.) That the under-mentioned students belong to the classes on whom payments are made according to the rules of the Science and Art Directory, that is to say, they come within one of the following categories :—

a. Persons in the receipt of weekly wages, and their children if not gaining their own livelihood.

b. Teachers and pupil-teachers of elementary schools in connexion with the English or Scotch Education Departments, or under the Commissioners of National Education, Ireland; and their children if not gaining their own livelihood.

c. Persons in the receipt of not more than 400*l.* per annum from all sources, *i.e.*, who are allowed an abatement on the income tax, and their children if not gaining their own livelihood.

d. Scholars in public elementary schools within the meaning of the Elementary Education Acts, and scholars who on leaving the elementary school are proceeding with their education in Science or Art schools or classes.
e. Students in an organized Science school under public management or in a night class for industrial students as defined in § XXXII., pp. 13 and 14 of the Science and Art Directory.

(4.) That the teacher(s) { is / are } duly qualified, according to §§ 8 and 9, at p. 61 of the Science and Art Directory of 1893, to earn payments in each of the subjects taught by { him / them }.

* Insert place of meeting.
† Insert date.

Examined and certified at a meeting of the Committee held for that purpose at*_____ on the †_____ day of_____ 1894.

_____
_____ *Chairman of Meeting.*
_____

{ Autographs Signatures of three Members of the approved Local Committee present at the Meeting.

The following will be filled up at the Department.

Entered *D* 2.

Certified correct.

Pay to_____ £ : :

_____

_____ Certifying Officer.

_____

Names of Students claimed upon.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, EACH ON A SEPARATE LINE, his or her several successes (if more than one), and the amount claimed on each success *after making the proper deductions*. Abbreviations should be used to indicate the subject of Examination, thus:—

Model Drawing (*Elementary and Advanced Stages*).	M.	Historic Ornament, Subject 22*d* -	H.O.
Freehand Drawing of Ornament (*Elementary and Advanced Stages*).	F.	Painting from Still Life, Subject 15	P.S.L.
Drawing in Light and Shade, Subject 5*b*. (*Elementary and Advanced Stages*).	L.S.	Painting Ornament in Monochrome, Subject 11*a*.	P.O.M.
Anatomy, Subject 9 - - -	Anat.	Drawing the Antique from Memory, Subject 8*f*.	A.M.
Principles of Ornament, Subject 22 (*Elementary and Advanced Stages*).	P.O.	Architectural Design, Subject 23*b* -	A.D.
Perspective, Subjects 1*c* and 1*e* (*Elementary and Advanced Stages*).	P.	Modelling (*Elementary Stage*), Subject 18*a*.	Mod. 18*a*.
Design, Subjects 23*c* and 23*d* (*Elementary and Advanced Stages and Honours*).	D.	Modelling from the Life, Subject 19*h*	Mod. L.
Drawing from the Antique, Subject 8*b*[2].	A.	Modelling from the Antique, Subject 19*i*.	Mod. A.
Drawing from the Life, Subject 8*c*[3]	L.	Modelling, Design, Subjects 23*e* and 23*f* (*Elementary and Advanced Stages and Honours*).	Mod. D.
Architecture, Subject 1*d*. - -	Arch.		

The statement "Father deceased" will not be accepted as a satisfactory description; it will be necessary, in all cases, to quote the letter of the category in which the Student is classed (*see p.* .)

1. Student's No. in School Register.	2. Names of Students in alphabetical order.		3. Age.	4. Category of each Student; give index letter, see p. (3).	5. No. of regd. attendances in groups of Art Subjects.		6. Successes obtained at the Personal Art Examinations, 1894.			7. Highest success in same or corresponding Subject in any previous Examination.	8. Amount claimed.	9. Payments of 3*l*. on account of Free Student, or Local Scholar.	10. 5*l*. on account of Nat. Scholar, Student in training, or Royal Exhibitioner.	11. Payments of 40*s*. or more up to 60*s*. per Student on account of works.
	Surname.	Christian Name.			No. of Attces.	Group.	Subject.	Stage.	Class.		£ *s.*	£	£	£ *s. d.*

Sum claimed in respect of works by Students on account of each of whom less than 40*s*. is claimable - - -

Claim on account of ____ Art Pupil Teachers (*employed in Schools of Art or Branch Schools of Art only*). .....

(A stamped receipt signed by the Art Pupil Teacher should, in every case, be sent to the Department with this Form of Claim. *See* Science and Art Directory, Edition of 1893, par. 33 (*b*), p. 72.)

Cost of packing case for transmission of works. (No claim may be made unless a voucher has been sent up with the works, as required by Circular Letter, No. 564 or 564*a*.) .....

Total £

The following will be filled up at the Department :—

The Art pupil-teacher(s) { is / are } qualified and { his / their } appointment(s) duly approved by the Department according to the terms of par. 33 (*b*), page 72, Science and Art Directory, 1893. There are _____ satisfactorily taught students of the industrial classes of which _____ are named in the claim and _____ are not named, payment for them being included in the lump sum £ _____ for works.

The students _____ _____ _____,

_____

_____

_____

in respect of whom free-studentships are granted are either draughtsmen, designers, modellers, or handicraftsmen, have each gained a first class in the Art Examinations (Advanced Stage) and on account of whose works a payment of at least 2*l.* has been awarded at the preceding annual examination, have attended the School of Art for two consecutive years, are prepared to attend regularly for the year following the date of their appointment, and were recommended by the local committee of the school who have undertaken to admit them to the school without payment of fees for that year. (*See* par. 33*a*, p. 71, and par. 45, p. 74, Science and Art Directory, 1893.)

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APPENDIX D.

Syllabus of the Subjects in which Examinations in Science are held by the Department of Science and Art.

SYLLABUS OF THE SCIENCE SUBJECTS.

The following Syllabuses have been prepared in order to afford candidates some guide to their reading; but it must be understood that the questions in the examination need not necessarily be on the specific points enumerated.

The examination is by paper, but *vivâ voce* examination may be resorted to. The examination in each subject is distinct.

These Syllabuses can be had at 1*d.* each, or 6*d.* a dozen.

[*See* list of publications at end of Directory.]

SCIENCE SUBJECT I.—PRACTICAL PLANE AND SOLID GEOMETRY.*

The examination questions will be given with the object of testing the candidate's knowledge of the **principles** of the subject, and in order to obtain a class it will not be sufficient to have merely learned a few problems by heart. In awarding marks, the neatness and general style of the drawing will be taken into consideration.

In addition to the questions in Practical Geometry a few questions in Graphic Arithmetic or Statics will be given in each stage. These questions will be alternative with and in addition to those in Practical Geometry, the candidate being allowed to choose some of them in place of questions in plane or solid Geometry. No marks will be given for Arithmetical or Algebraic solutions.

The First Stage or Elementary Course is divided into two Sections, in which separate examination papers will be set. Thus Candidates for examination in Geometrical Drawing may confine themselves to the subjects detailed in Section I.

Candidates for examination in the Elementary stage of Practical Plane and Solid Geometry must be instructed in both Sections I. and II.

First Stage or Elementary Course.

Section 1.

Geometrical Drawing.

1. Construction and use of plain scales and scales of chords.
2. Proportional division of lines.
3. Mean third and fourth proportional to given lines.
4. Elementary constructions relating to lines and circles required in drawing out geometrical patterns and simple tracery.

* *This syllabus has been recast.*

5. Reduction and enlargement of plane figures.
6. Construction of regular polygons on a given side.
7. Inscription of regular polygons in a given circle.
8. Construction of irregular polygons from given data.
9. Reduction of irregular figures to triangles or squares.
10. Elementary constructions relating to ellipses.
11. Plan, elevation, and section of cube, pyramid, prism, cylinder, cone, and sphere, singly or in combination, in simple positions.

Section 2.

Geometrical Drawing.

12. *Various problems relating to lines, circles, and plane figures, suitable to students who have received one year's instruction.*
13. *Construction of similar figures.*

Solid Geometry.

1. The principles of projection. Definition of terms in general use, such as projector, plan, elevation, section, trace, &c.
2. Simple problems relating to lines.
3. Simple problems relating to planes.
4. Plan and elevation of simple solids resting on the horizontal plane.
5. Plan and elevation of plane figures having given inclination of two sides or of plane and one side.
6. Plan and elevation of simple solids having one edge in the horizontal plane, and an adjacent face inclined at a given angle; or given the inclination of one face and one edge.
7. Sections of such solids by vertical and horizontal planes. In the elementary paper, given points or lines will be above the horizontal and in front of the vertical plane.

Graphic Arithmetic.

1. The representation of numbers by lines.
2. The multiplication of numbers by construction.
3. The division of numbers by construction.
4. The determination of the square root of numbers by construction.

Second Stage or Advanced Course.

Plane Geometry.

1. The construction of plain and diagonal "scales" to different linear units, English and foreign.
2. The division of a line in a given proportion, and in extreme and mean ratio. Construction for mean, third, and fourth proportionals, and for harmonic mean.
3. The construction of polygons from adequate conditions of sides, angles, area, or perimeter.
4. The constructions required in dealing with lines which intersect at points practically out of reach.
5. Miscellaneous problems relating to lines, circles, and plane figures.
6. The delineation of plane curves, such as the ellipse, parabola, hyperbola, cycloid, spirals, &c.
7. The construction of simple loci, both from geometrical and mechanical data, such as the practical setting out of curves described by particular parts of machines or link work.

8. The construction of curves from observed or tabular data, such as curves of varying pressure, temperature, resistance, and so forth, involving the elementary geometrical use of abscissa and ordinate.

Solid Geometry.

1. Miscellaneous problems relating to lines and planes.
2. Projections of the cube, prism, pyramid, tetrahedron, octohedron having given—
   a. A plane connected with the solid, and a line lying in that plane.
   b. Two lines connected with the solid.
   c. Two planes " " " "
   d. The heights of three points of the solid.
3. Sections of the above solids by vertical, horizontal, and inclined planes.
4. Problems relating to the sphere, cone, and cylinder,—
   a. Representation of those solids in given positions and in contact.
   b. Determination of tangent planes to them.
   c. Determination of their sections by planes under given conditions.
   d. Intersection of their surfaces when variously combined or "interpenetration."
5. The screw, delineation of the simple helix. The square and V-threaded screw.
6. Simple cases of cast shadows, the rays of light being supposed parallel.
7. Principles and practice of isometric projection.

N.B.—The solid geometry problems may be worked either by means of projections on two co-ordinate planes, or by horizontal projection with figured indices, which will often simplify the constructions. Either mode of representation will be employed for the data of the questions, as may be most convenient.

Graphic Arithmetic and Statics.

1. Multiplication and division of numbers by lines.
2. Determine by construction lines representing the values of such expressions, as—

$$\sqrt{m} \quad \sqrt{\frac{m}{n}}, \quad \sqrt{\frac{1}{m}} \text{ &c.; } m \text{ and } n \text{ being given numbers.}$$

3. Representation of areas and volumes by lines.
4. Resolution of a given force in two directions.
5. Determination of the resultant of any number of forces acting at a point or parallel.
6. Graphic determination of the moment of a force, and of the resultant moment of several forces.

Examination for Honours.

Plane Geometry.

Miscellaneous problems relating to lines and circles. Construction of plane figures from different data. Construction from different data of the ellipse, parabola, hyperbola, their tangents and centres of curvature. Delineation of various curves which occur in the arts, or find place in the geometry of machines. *Linkages.* The cycloid *and analogous curves*, with their tangents, normals and centres of curvature. The evolute and involute of the circle and ellipse. The Archimedean and logarithmic spirals. Interpretation of loci from geometrical and mechanical data. Construction of curves obtained by observation, or given by self-recording instruments.

Solid Geometry.

Miscellaneous problems relating to lines and planes. Use of contours in determining the intersection of surfaces. Projection of solids in various

positions. Sections of solids and surfaces of various forms by planes. Intersection of curved surfaces and interpenetration of solids. Development of conical and cylindrical surfaces. Representation of helical and twisted surfaces. Tangent planes to surfaces of the second degree. Shadows cast by solids of various form on each other and on any plane, the rays of light being either parallel or convergent. Principles of isometric projection. Isometric projection of objects of various forms. Principles of map projection. Principles and practice of perspective.

Graphic Statics.

1. Representation of numbers, areas, and volumes by lines.
2. Composition and resolution of forces acting in any direction in a plane.
3. Graphic determination of centres of gravity *moments of inertia, and radius of gyration* of plane figures.
4. Determination of the resultant couple of a system of couples in one plane.
5. *Curve of pressure in circular arches.*
6. Construction of stress diagrams for simple braced structures variously loaded.

[*N.B.—In the construction of stress diagrams, Students are strongly advised to adopt the notation used by von Ott & Clarke, indicating each bar of a braced structure and its corresponding reciprocal by the same number.*]

Appendix to Syllabus of Subject I.

Teachers of Science Classes are strongly recommended to study the following brief outline of an elementary course of Descriptive Geometry, and to base their teaching upon it. The problems therein enumerated should be thoroughly mastered, as they illustrate important principles and involve constructions which are of constant occurrence. When a difficulty presents itself in realising the conditions of a problem, the student should be encouraged to extemporize a model by bending up stiff paper or card to represent the planes of projection, cutting out pieces of card or paper to represent planes in various positions, and using pencils, pieces of wire or thread to represent lines. By this means the habit of thinking out a question will be developed.

1. Represent (by its plan and elevation) a point in space in all possible positions with respect to the planes of projection (*i.e.*, above or below the horizontal plane, before or behind the vertical plane). Conversely given the projections of a point, state its position with respect to the planes of projection.
2. Given the plan and elevation of a line, with its extremities situated in given positions with regard to the co-ordinate planes, determine:—
   - *a*. The traces.
   - *b*. The true length, and inclination to each plane of projection. Conversely, draw the plan and elevation of a line of given length when inclined at $a°$ to the horizontal, and $b°$ to the vertical plane.
   - *c*. Obtain a new elevation of the line on any assigned ground line.
3. Assume two intersecting lines and determine the real angle they contain.
4. Draw the projection of a line which is parallel to a given line.
5. Represent by their traces planes in the following positions:—
   - *a*. At right angles to one plane of projection and inclined at a given angle to the other.
   - *b*. At right angles to both planes of projection.
   - *c*. Parallel to the ground line.
6. Given the traces of a plane in any position with respect to the planes of projection. Determine the inclination of the plane to both planes of projection and the real angle contained by the traces. Conversely, obtain the traces of a plane which makes given angles with the planes of projection.
7. Determine the intersection of two given planes and the real angle they contain. Conversely, determine the traces of a plane which makes a given angle with a given plane.
8. Determine a plane parallel to a given plane and (*a*) containing a given point; or (*b*), at a given distance from the given plane.

9. Determine the intersection of a given line and plane and the angle contained between them.

10. From a given point drop a perpendicular on a given plane. At a given point on a given plane erect a perpendicular of given length.

11. In a given plane place a horizontal line or a line having any given inclination. From a given point draw a line parallel to a given plane and inclined at a given angle.

12. Obtain the projections of any polygon, given the inclination of its plane and of a side, diagonal, or any line connected with it.

13. Determine a plane (*a*) to contain three given points, (*b*) to contain two lines including a given angle and inclined at given angles. Obtain the projections of any polygon, given the inclination of two adjacent sides, of a diagonal and adjacent sides, or generally of any two intersecting lines connected with the polygon.

14. Draw the plans of the cube, prism, pyramid, tetrahedron, octohedron (*a*) resting with one face on the horizontal plane (*b*) one edge in the horizontal plane and an adjacent face inclined at a given angle. Make elevations of these solids on different ground lines and sections by different vertical planes.

15. Given the plan and one elevation of any object of simple form make a new elevation, or a section on any given line.

SUBJECT II.—MACHINE CONSTRUCTION AND DRAWING.*

This subject includes a knowledge of the form of the parts of machines, the physical characteristics of the materials used in machine construction, the various workshop processes employed in giving the materials the required shape and size, the magnitude of the straining actions to which they are exposed, and the methods of estimating the dimensions necessary to withstand those straining actions.

In addition to this knowledge the possession of which may be shown by means of written descriptions, freehand sketches and calculations, a candidate for examination in this subject will be required to be able to draw neatly, to scale, the whole or part of a machine either from dimensioned sketches, which are provided, or from his own design.

In the Elementary Stage.

A candidate will be required to draw in simple or orthographic projection neatly in pencil to a given scale, two or more views (sectional or outside), of a simple portion of a machine in common use. The sketches from which the drawings are to be produced will be given. They will in general be incomplete, and be drawn purposely somewhat out of proportion, and the candidate will be required to set off, correctly to scale, dimensions, some of which are given on the view he is drawing, the remainder being obtained from the other views. He will be expected to add parts which are omitted from some of the sketches, but shown in shape and size in others. He will further be expected to draw from his own knowledge the fastenings which are suitable for connecting together the machine parts which are the subject of the example, and, in sectional views, to draw lines neatly by freehand to indicate parts cut by the planes of section, taking care to slope the lines on all the parts of the same piece in the same direction, and of contiguous pieces in directions differing from one another.

In some simple cases an additional new view (outside or sectional), which is not shown in the sketches will be required to be drawn, and details which are shown in separate detached sketches will be required to be inserted in their proper places in the general drawing.

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* *This syllabus has been recast.*

The various views required must be placed in position so as to project from one another in order to show that the candidate appreciates the fact that he is producing a representation of a solid piece of machinery and not merely copying a sketch. No credit whatever will be given unless the candidate shows some knowledge of projection by drawing two views of at least one subject in their proper relative situations.

Teachers are enjoined not to rely too much on drawings in giving instruction to their classes, but to make use also of actual simple machine parts or models of them.

It is desirable that centre lines should be shown distinctly, and the parts of other lines continued too far, and not needed in the finished drawing, should be rubbed out.

In order to save time during the examination the drawings should not be inked in, nor should the figured dimensions be inserted.

The following list of examples which have been set in previous years will give a general indication of what may be expected and prepared for :—

PARTS OF AN ENGINE. — Piston. Piston rod end and guide block. Connecting rod. Crank shaft. Excentric and rod. Valve rod end. Simple form of loaded governors.

PARTS OF A BOILER.—Cusset stay. Mud hole door. Water gauge cock. Simple feed pump.

PORTIONS OF MACHINE TOOLS.—Fast headstock and spindle of a lathe. Rest for a hand-tool for a lathe. Jaw of a dog-chuck for a lathe. Quadrant for carrying change wheels for a lathe. Ram of a slotting machine. Parallel jaw vice.

MILL WORK.—Footstep bearing for an upright shaft. Joint for segments of large spur wheel. Bearing for turbine shaft. Wall bracket.

GENERAL FITTINGS. — Hooke's coupling. Ball bearing for a tricycle. Hydraulic pipe joint. Union joint.

Besides making drawings, candidates will be required to answer some of a number of questions on machine construction, and illustrate those answers by sketches. Unless specially instructed to the contrary the sketches should be drawn freehand. The capability of making freehand sketches of parts of machines from memory is of the greatest value to an engineer, and when the sketches are drawn to a tolerable proportion they will be estimated by the examiners at at least as high a value as those drawn more accurately by means of instruments with a much larger expenditure of time.

The details of this portion of the subject may be classified as follows :—

FORMATION OF PARTS OF MACHINES WHICH ARE IN WORKING CONTACT :—

JOURNALS OF SHAFTS AND BEARINGS. — Constructions to facilitate adjustment for wear and renewal by cylindrical bushes, cones, and brasses, or steps with caps.

Methods of preventing end movement by groove and pin, by collars and by simple forms of footstep or pivot bearings. Joint pin. Knuckle joint. Methods of fixing pin rigidly to the fork portion of the joint.

Simple forms of lubricators.

RUBBING SURFACES OF SLIDING PIECES.—Method of adjustment for wear as in the slide rest of a lathe or other machine tool.

HELICAL OR SCREW MOTION.—Construction of a helical curve. Meaning of the terms pitch and angle of thread.

SURFACES SUITABLE FOR ROLLING CONTACT.—Cylinders, frustums of cones and spheres.

SURFACES FOR A COMBINATION OF ROLLING AND SLIDING CONTACT. Elementary information relative to the form of spur and bevil wheels.

BELT GEARING.—Advantage of a rounded surface. Methods of connecting the ends of a belt.

CONSTRUCTIONS TO PERMIT OF THE APPLICATION OF THE URGING FORCE AND THE WORKING RESISTANCE TO THE MOVING PARTS.—Simple forms of

pistons, plungers, and stuffing boxes. Use of leather in hydraulic work. Simple forms of slide, lift, and screw down valves, and two-way turn cocks.

Methods of Construction to facilitate the Manufacture of Machine Parts :—

Connections, whereby parts more easily manufactured and more readily renewed when detached, are joined together more or less permanently and rigidly to compose one single piece of a machine. Use of chipping strips.

Riveted Joints.—Forms of rivets. Junction of plates by single and double riveting in chain and zig-zag with lap and butt joints. Use of angle, tee, and channel irons.

Bolted Joints.—Bolts with various forms of heads and nuts. Studs and screws. Use of washers. The Whitworth and square form of screw threads. Raised threads. Methods of preventing nuts from working loose. Prevention of bolts from turning when screwing up the nut. Forms of spanners.

Cotters.—Draw of cotter and clearance. Use of jib. Methods of preventing cotters from working loose.

Flanged Joints of pipes and cylinders. Methods of making them steam and water tight. Use of a centring ring in a cylinder cover. Union joint for small pipes. Socket joint.

Construction of the frame of a Machine.—Methods of securing frames to foundations. Simple forms of pedestals for supporting a shaft, and methods of attachment to the frame or to a bracket. Simple forms of brackets, hangers, and wall boxes.

Boilers.—Elementary knowledge of their construction. The methods of uniting the plates. The strengthening of a boiler by the use of bar and gusset stays.

Primary Pieces.—Connection of the parts of a shaft. Crank pin to crank arm and arm to shaft. Use of sunk, saddle, and feather keys. Methods of withdrawing keys. Box and flange couplings. Connection of the two parts of an excentric sheave, excentric radius, travel of valve. Connection of the parts of sliding pieces. Piston to rod. Rod to crosshead or guide-block, and slide valve to valve rod.

Secondary Pieces.—Parts of a connecting rod. Construction of an excentric strap and rod.

Physical Characteristics of the Common Materials used in Machine Construction.—Elementary information as to the relative strength, durability under wear, resistance to corrosion, and capability of being cast or forged of iron, steel, brass, and copper. Any question which may be set on the strength and proportions of machine parts will be only of a very elementary character.

Workshop Processes.—Elementary information of the processes by which the desired shape is given to machine parts, including the use of the lathe, the planing, shaping, slotting and drilling machines.

The Advanced Stage.

Will include all that has been detailed for the Elementary Stage.

The examples to be drawn to scale will be a piece of machinery of more complicated construction, requiring the candidate to possess more capability of reading drawings, and the greater part of the drawing required will consist of views not shown, but which will have to be deduced from information given in other views. A greater facility of execution will be expected to be shown by a larger quantity of drawing of a better finish than in the Elementary Stage.

The following is a list of examples which have been set in some previous years :—

Parts of an Engine.—Link reversing gear. Regulator valve. Hydraulic engine. Double-ported slide valve.

PARTS OF A BOILER.—Giffard's injector. Safety valve. Double acting pump.

MILL WORK.—Wall fixing with shafts and bevel wheels. Collar bearing for suspended vertical shaft. To answer the questions a more intimate and detailed knowledge of the parts of machines previously enumerated will be required, and of the following in addition :—

FORMATION OF PARTS OF MACHINES WHICH ARE IN WORKING CONTACT.

BEARINGS AND JOURNALS OF SHAFTS.—Methods of completely providing for wear in any direction. Bearings in which the direction of the centre line of the shaft is capable of automatic adjustment. Bearings for working under water; for very high speeds; for locomotive carriages. Construction permitting the use of antifriction soft metal.

RUBBING SURFACES OF SLIDING PIECES.—Use of renewable slipper piece with the guide block of an engine. Automatic lubrication of slides. Guides for valve rods.

HELICAL OR SCREW MOTION.—Screw and nut for transmitting energy. Adjustment for wear of nut.

SURFACES SUITABLE FOR ROLLING CONTACT.—Methods of keeping in place live rollers used in cranes and heavy revolving pieces.

SURFACES FOR A COMBINATION OF ROLLING AND SLIDING CONTACT.—Simple forms of cams and ratchets. Formation of teeth of wheels. Mortice wheels.

BELT GEARING.—Fast and loose pulleys and strap fork arrangements. Length of belt. Rope pulleys. Gearing chains and pulleys.

CONSTRUCTIONS TO PERMIT OF THE APPLICATION OF THE URGING FORCE AND WORKING RESISTANCE TO THE MOVING PARTS.—Metallic gland packing. Hydraulic pistons. Pump buckets and valves. Mechanically controlled pump valves. Stop and throttle valves. Arrangements for relieving the pressure on slide valves. Expansion valves for steam engines.

METHODS OF CONSTRUCTION TO FACILITATE THE MANUFACTURE OF MACHINE PARTS.

RIVETED JOINTS.—Treble riveted joints. Arrangement where three or more plates overlap. Caulking. Joints in the bars. Connection of parts in girder work. Ordinary proportions of joints and simple calculations of strength.

BOLTED JOINTS.—Ordinary proportions of bolts and nuts and simple calculations of strength. Buttress form of screw thread. Foundation and wall bolts and washers. Double ended bolts.

COTTERS.—Ordinary proportions of steel and iron cotters.

FLANGED JOINTS of pipes and cylinders. Diameter and number of bolts. Joints in copper pipes. Expansion joint for steam pipes.

CONSTRUCTION OF THE FRAME OF A MACHINE IN PARTS.—Fixings. Hangers and brackets for carrying pedestals of shafts connected by bevel wheels. Engine beds.

BOILERS.—Use of bridge or girder stays for strengthening flat surfaces of boilers.

PRIMARY PIECES.—Ordinary proportions of keys. Simple forms of disengaging couplings and friction clutches. Methods of constructing fly-wheels, pulleys, and spur-wheels in parts.

SECONDARY PIECES.—Forms of section suitable for transmitting a tensile force and a thrust. Form of section suitable for a locomotive coupling rod.

PHYSICAL CHARACTERISTICS OF THE COMMON MATERIALS USED IN MACHINE CONSTRUCTION.—Simple questions will be set on the strength and proportions of elementary machine parts and of the pressures at surfaces in working contact.

WORKSHOP PROCESSES.—Use of the milling machine. Conditions suitable for its application.

In the Honours Stage.

The examination is twofold. A paper will be set which may include any question relating to the design, the method of construction, and the use of any machine. As the subject is large, and includes all the various branches of engineering practice, a considerable choice of questions is provided, the candidate being restricted to answering only a limited number. In general about half the questions will be set on the theoretical portion of the subject and will require a knowledge of how to apply the principles of Applied Mechanics in the calculations relating to machines. This part of the subject will apply equally to the machines employed in all branches of engineering. The other questions will require answers of a descriptive character involving an intimate knowledge of special machines.

Those candidates who answer the questions in this paper in a sufficiently satisfactory way will be permitted to enter for a practical examination which will be held at South Kensington about four weeks after the written examination. At the practical examination the candidate will be required to execute a drawing, or design a portion of some machine from given data. In this part of the examination the candidate will in general be allowed the free use of text and note books so that he may to a large extent be working under conditions similar to those which obtain in an engineer's drawing office.

Candidates must themselves provide drawing instruments and all necessary materials, except drawing paper and drawing boards, which will be supplied by the Department.

SUBJECT III.—BUILDING CONSTRUCTION.

A larger number of questions will be set in the examination papers for the Elementary and Advanced Stages than the candidates will be allowed to attempt, so that he will, to a certain extent, be able to show his knowledge in such branches as he may, from circumstances, have paid special attention to.

First Stage, or Elementary Course.

It is assumed that the student has already mastered the use of the following drawing instruments;—rulers, ordinary and parallel; ruling pen; compasses, with pen and pencil bow-sweeps, as well as the construction and use of simple scales, such as 1, 2, 3, or more feet to the inch, showing inches; or such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{3}{5}$, $\frac{3}{4}$, or other fraction of full size, or of any given scale or drawing: also the meaning of such terms as Plan, Elevation (front, back, or side), Section, Sectional Elevation.

He should understand the object of bond in brickwork, *i.e.*, English bond, Flemish bond, or English bond with Flemish facing, and how it is attained in walls up to three bricks thick in the following instances, viz., footings with offsets, angles of buildings, connexion of external and internal walls, window and door openings with reveals and square jambs, external gauged arches (camber, segmental, and semi-circular), internal discharging arches over lintels, and inverted arches.

He should know where to put wood bricks, or plugging, and their use; the construction and uses of brick corbeling, and the construction of trimmer arches in fire-places.

He should be able to give sections and elevations to scale of the following kinds of mason's work, viz., uncoursed and coursed rubble, block in course, and ashlar, with their bond, and the proper dimensions of the stones, as to height, width of bed, and length; and of the following dressings, viz., window sills, window and door jambs, plain window and door heads, door steps, string courses, quoins, copings, common cornices, blocking courses; and of the following methods of connecting stones, viz., by cramps, dowels, joggles, and lead plugs.

He should be able to show how to join timbers by halving, lapping, notching, cogging, scarfing, fishing, and mortice and tenon; as applied to wall plates, roof timbers, floors, ceilings, and partitions.

He should be able to draw, from given dimensions, couple, collar, and king-post roofs, showing the details of the framing and of the ironwork.

He should be able to draw, from given dimensions, single, double, and framed floors, with or without ceilings beneath them; showing modes of supporting, stiffening, and framing the timbers, trimming round hearths and wells of stairs; also floor coverings of boards or battens, rebated and filleted, ploughed and tongued, and laid folding, with straight or broken joints, beveled or square heading joints.

He should be able to draw in elevation, from given dimensions, a framed partition with door openings.

He should be able to draw in elevation, and give vertical and horizontal sections of solid door frames and window frames.

He should be able to describe, by drawings, beadings of different kinds, dovetailing, cross-grooving, rebating, plough-grooving, chamfering, rounded nosing, and housing.

He should be able to draw in elevation, and give vertical and horizontal sections of, the following doors, viz., ledged, ledged and braced, framed and braced, paneled, and the mode of putting them together, position of hinges and furniture; as well as to describe, by drawing, the following terms as applied to panelled doors, viz., square and flat, bead butt, bead flush, moulded, all on one or both sides.

He should be able to draw in elevation, and to give vertical and horizontal sections of the following window sashes and frames, viz., single or double hung sashes with square, bevelled, or moulded bars, and cased frames; casement sashes hung to solid frames, with method of hanging and securing in each case.

He should be able to show, in elevation and section, the lead-work connected with chimneys, ridges, hips, valleys, gutters, and lead-flats.

He should be able to give an elevation and section of the slating of a roof laid with duchess or countess slates on boards or battens.

He should be acquainted with the proper cross section for cast-iron beams for use in floor girders or bressummers, or as cantilevers; and be able to draw such a section in its right proportions from given dimensions of flanges.

He should be able to draw in elevation, from given dimensions and skeleton diagrams, ordinary iron roofs up to 40 feet span, showing the sections of different parts, and methods of connecting them.

Second Stage, or Advanced Course.

In addition to the subjects enumerated for the Elementary Course—in all of which questions of a more complicated nature may be set, combining work done by the different trades—the knowledge of the students will be tested under the following heads, viz.:—

1st. Freehand sketches explanatory of any details of construction, such as the joints of iron and wooden structures, and other parts requiring illustration on an enlarged scale. These sketches may be roughly drawn, provided they are clear and capable of being readily understood.

2nd. The nature of the stresses to which the different parts of simple structures are subjected, as follows:—

In the case of beams either fixed at one or both ends, or supported or continuous, the student should know which parts of the beam are in compression, and which in tension.

He should be acquainted with the best forms for struts, ties, and beams, such as floor joists, exposed to transverse stress.

He should know the difference in the strength of a girder carrying a given load at its centre, or uniformly distributed.

In the ordinary kinds of wooden or iron roof trusses, and framed structures of a similar description, he should be able to distinguish members in compression from those in tension.

He should be able, in the case of a concentrated or uniform load or any part of a beam supported at both ends, to ascertain the proportion of the load transmitted to each point of support.

3rd. The nature, application, and characteristic peculiarities of the following materials in ordinary use for building purposes, viz.:—

Bricks of different kinds in common use, York, Portland, Caen, and Bath stones (or stones of a similar description), granite, pure lime, hydraulic lime,

Portland and Roman cement, mortars, concretes, grout, asphalte, timber of different kinds in common use, cast and wrought iron, lead.

4th. Constructive details, as follows:—

The ordinary methods of timbering excavations, such as for foundations to walls, or for laying down sewers; the erection of bricklayer's and mason's scaffolding; the construction of travelers; the use of piles in foundations, hoop iron bond in brickwork, diagonal and herring-bone courses in ditto, damp-proof courses, bond timber in walls and the objections to it.

He should know how bricks are laid in hollow walls, window or door openings with splayed jambs, flues, chimneys, fireplaces, and arches up to about 20 feet span; how mortar joints are finished off, and the thickness usually allowed to them; why bricks and stones ought to be wetted before being laid.

He should be acquainted with the construction of brick ashlar walls, rubble ashlar walls, stone stairs, wooden stairs (both dog-legged and open newel), skylights, fire-proof floors (such as brick arches supported on rolled or cast-iron girders, Fox and Barrett's, and Dennett's patent concrete floors), circular and egg-shaped drains, roofs of iron or wood, for spans up to 60 feet; the fixing of architraves, linings and skirtings to walls, shutters to windows, lath, plaster, and battening to walls, roof coverings of tiles and zinc, slate ridges and hips.

Written answers will be required to some of the questions.

Examination for Honours.

The Candidate will be called upon to answer in writing—illustrated by sketches, either freehand or to scale, as directed—questions on all the subjects previously enumerated for the elementary and advanced Courses.

He must possess a more complete knowledge of building materials, their application, strength, and how to judge of their quality; and in the case of iron, of the processes of manufacture, and the points to be attended to in order to insure sound castings, and good riveting.

He must be able to solve simple problems in the theory of construction, and to determine the safe dimensions of iron or wooden beams subjected to dead loads.

In ordinary roof trusses and framed structures of a similar description, he must be able to trace the stresses, brought into action by the loads, from the points of application to the points of support, as well as to determine the nature and amount of the stresses on the different members of the truss, and consequently, the quantity of material required in each part.

In ordinary walls and retaining walls, he must be able to ascertain the conditions necessary to stability, neglecting the strength of the mortar.

Those candidates who answer the questions in the written paper in a sufficiently satisfactory way will be permitted to enter for a practical examination which will be held at South Kensington. This examination will be held on one day. The time allowed for work will be seven hours—three hours in the morning and four hours in the afternoon. Candidates will be required to design some small building or portion of a building, giving a plan, section, and elevation.

When candidates are directed to attend the examination they will be made acquainted with the nature of the building they will be called upon to design.

Candidates must themselves provide drawing instruments, T squares, and all other necessaries, except drawing paper and drawing boards, which will be supplied by the Department.

SUBJECT IV.—NAVAL ARCHITECTURE.

First Stage or Elementary Course.

Candidates for the first stage will be required to possess sufficient knowledge of practical shipbuilding to be able to describe the methods usually adopted by the workmen in forming and combining the several parts of a ship's hull; to be able to make sketches to scale; and to prepare the simpler calculations usually made in drawing offices, such as those relating to the areas of plane curves, &c.

The candidates will not be required to have a knowledge of all the systems of shipbuilding now practised, whether in (1) iron and steel, or (2) in wood and composite construction. A sufficient number of questions will therefore be set to enable a candidate to pass in either of these branches.

Second Stage or Advanced Course.

Candidates for the second stage will, in addition to that which is prescribed for the first stage, be required to answer questions relating to the strains to which ships are liable; the structural arrangements which give the strength required to resist these strains; the nature of the materials used in shipbuilding, and the tests to which these materials are subjected; also to possess a knowledge of laying off on the mould loft floor; and more advanced calculations, such as those for the centres of gravity of the areas of plane curves, and for strength of butt-fastenings in iron and steel ships, &c.

Examination for Honours.

The honours examination, in addition to what is prescribed for the preceding courses, will embrace questions relating to the higher calculations, such as those for displacement, centre of buoyancy, longitudinal and transverse metacentres, moment to change trim, strength to resist longitudinal bending, areas of wetted surface, &c.

Those candidates who answer the questions in the written paper in a sufficiently satisfactory way will be permitted to enter for a practical examination which will be held at South Kensington. This examination will be held on two consecutive days. The time allowed for work on each day will be seven hours.

Candidates will be required to make a sheer draught of a vessel from particulars to be furnished.

Candidates must themselves provide all drawing instruments, moulds, battens, straight edges, squares, &c., and all other necessaries, except drawing boards, drawing paper, and batten weights, which will be furnished by the Department.

Neatness and accuracy in drawing will be insisted on.

SUBJECT V.—MATHEMATICS.

This subject is divided into seven stages. The examination in stages 1, 2, and 3 is taken on one evening; in stages 4 and 5 on another; and in stages 6 and 7 on a third.

A student may in any one year come up on all three evenings, but he may only take up one stage on each evening.

Sufficient questions will always be given in the early portions of each stage to enable a student with a thorough knowledge of them by good answering to obtain a pass in the Elementary Stage or a second class in the Advanced Stage.

First Stage.

No candidate will be allowed to pass who fails to obtain marks in any one of the three sections of this stage.

1. Arithmetic.—The principles of arithmetical operations, and their application to simple questions. The fundamental rules applied to whole numbers and to vulgar and decimal fractions. Proportion. Extraction of the square and cube roots of numerical quantities. Arithmetic as applied to ordinary questions of commerce and trade, including such questions as arise out of Bills, Interest, Per-centages, Purchase and sale of stocks and shares. Division of profit and loss. Estimates. Weights and measures. The metrical system.

2. Geometry.—The properties of lines, triangles, and rectilinear figures, as far as they are treated in the 1st Book of Euclid.

   The questions in this subject will generally be given so as to bring out as far as possible the candidate's knowledge of the principles of

geometry. They will not, commonly, be set in the form of Euclid, but will consist as far as may be of definitions and easy geometrical theorems which can be proved, and problems which can be solved by the application of the well-known properties of triangles, &c. Any solution, whether in the words of Euclid or not, which shows that the candidate possesses an accurate method of geometrical reasoning will be accepted; but he should not use in his demonstrations any single angle greater than an obtuse angle. In other words, Euclid's limitation of the magnitude of an angle should be observed in Elementary Geometry. Candidates should endeavour to draw good figures, and should as much as possible keep the demonstration on the same page with the figure.

3. ALGEBRA.—Definitions and explanations of algebraical signs and terms. Numerical substitutions. Integral indices. Addition, subtraction, multiplication, and division of algebraical expressions and fractions. Factors, greatest common measure and least common multiple. Reduction of fractional expressions. Simple equations and problems producing them.

SECOND STAGE.

No candidate will be allowed to pass who fails to obtain marks in any one of the three sections of this stage.

All the preceding subjects, with these additions :—

1. GEOMETRY.—The properties of rectangles and circles, as far as they are treated in the 2nd and 3rd books of Euclid.

   The remarks under the head of geometry in the first stage are applicable to the second stage. Answers to questions may be given on any system which the student may have followed, provided the reasoning be clear and accurate.

2. ALGEBRA.—Involution and evolution. Surds. Quadratic equations, and problems producing them. Ratio. Proportion.

3. PLANE TRIGONOMETRY.—Definitions. Measurement of angles by degrees or grades; the circular measure of an angle. The trigonometrical functions, and the conversion of one into another. Use of the positive and negative signs to denote contrariety of direction. Tracing of the trigonometrical functions in magnitude and algebraic sign through the four quadrants. The arithmetical values of the trigonometrical functions of 30°, 45°, 60°, 75°, 90°, &c.

   LOGARITHMS.—Definition. Multiplication, Division, Involution and Evolution by logarithms. The use of tables of logarithms of numbers, and of sines, cosines, &c. of angles. Tables of proportional parts for numbers and angles.

   TRIANGLES.—Solution of all cases of right angled and oblique triangles, and proofs of the requisite formulæ. Heights and distances. Area of a triangle.

THIRD STAGE.

All the preceding subjects, with these additions :—

1. ALGEBRA.—Permutations and Combinations. Progressions. Complete theory of indices. The Binomial theorem with any index.

2. PLANE TRIGONOMETRY.

   Formulæ for finding the sine, cosine, &c. of the sum and difference of two angles, and of the multiples and submultiples of an angle. Diameters of circles inscribed in and circumscribed about a given triangle. Areas of regular polygons inscribed in and circumscribed about a given circle. Area of a circle. Description and use of the vernier and of the theodolite and sextant.

A student may, in place of the preceding trigonometry, take up the elements of spherical trigonometry. Questions will be given in both subjects, but in this stage plane trigonometry and spherical trigonometry are alternative subjects; questions may be answered in either, but not in both.

3. Spherical Trigonometry.

Definitions and elementary properties of great and small circles; also of a spherical triangle and its sides and angles. Relations between the angles and sides of supplemental triangles. The fundamental relations between the trigonometrical ratios of the angles and sides of every spherical triangle. Solution of right-angled, quadrantal, and other spherical triangles. The analogies of Napier and the formulæ of Gauss.

Honours.

Candidates for Honours will be expected to show a sound as well as more advanced knowledge of the subjects of the preceding stages. They will be examined on some or all of the following points.

In Algebra:—Examples involving somewhat difficult transformations. The binomial theorem and the exponential and logarithmic series. The simpler tests of the convergence and divergence of series. Simple cases of the summation of series. Method of indeterminate co-efficients. Continued fractions. Elementary properties of numbers. In Geometry:—Problems in pure geometry, and problems requiring the aid of algebra or trigonometry for their complete solution. In Trigonometry:—Examples to test the familiarity of the student with the principles of the subject. Angles greater than two right angles. Relations bteween trigonometrical ratios and all the angles they indicate. Trigonometrical eliminations and transformations. Demoivre's theorem for an integral positive index. The exponential expressions for the sine, cosine, and tangent of an angle, and the resulting series. Trigonometrical series and expansions. Proportional parts. Calculation of the logarithms of the trigonometrical ratios by series. Advanced questions will likewise be set in spherical trigonometry.

Fourth Stage.

Plane Geometry.—Ratio and proportion. The similitude of figures. Proportional division of straight lines. The inscription of regular polygons in circles.

N.B.—A knowledge of the 4th and 6th Books of Euclid's Elements, supplemented by clear notions of the ratio and proportionality of incommensurable, as well as of commensurable magnitudes, will suffice. Correct demonstrations, however, derived from any other source will be accepted.

Solid Geometry.—The properties of straight lines and planes; their intersections, inclinations, parallelism, perpendicularity, &c.

Trihedral and polyhedral angles. Prisms and pyramids; their definitions, plane sections, similitude, &c.; their quadrature and cubature.

Elementary properties of the sphere, and of cylinders and cones with circular bases; their plane sections, tangent planes, surfaces, and volumes.

*Descriptive Geometry.—Representation of points, straight lines, and planes, by projections and traces on two orthogonal planes. The use of auxiliary projections and rabatments. Graphic solutions of problems concerning straight lines and planes; their intersections, inclinations, &c. Problems on trihedral angles.

Geometrical Conics.—Properties of the parabola, ellipse, and hyperbola deduced by pure geometry from definitions *in plano*.

Fifth Stage.

The preceding subjects of the fourth stage, together with the following:—

*Descriptive Geometry.—Problems concerning spheres, cylinders, cones, and simpler surfaces of revolution; their intersections by straight lines, by planes, and by one another; their tangent planes and normals, &c.

Spherical Trigonometry.—Definitions. Great and small circles. Angles and sides of spherical triangles. Relations between the angles and sides of supplemental triangles. The fundamental relations between the trigonometrical ratios of the angles and sides of every spherical triangle. Solution of right-angled, quadrantal, and other spherical triangles. The radii of their in- and circumscribed circles. The analogies of Napier and the formulæ of Gauss.

Co-ordinate Geometry.—Rectangular, oblique, and polar co-ordinates of a point, and transformations from one system of such co-ordinates to another.

Equations of straight lines, and the treatment of questions relative to their intersection, concurrence, inclination, parallelism, perpendicularity, &c.

Equations of circles, their tangents, and normals. Elementary properties of poles and polars relative to the circle. Questions concerning the intersection of circles, and the determination of circles which satisfy given conditions.

The simpler forms of the equations of the parabola, ellipse, and hyperbola, as determined from various definitions of those curves. The equations of their tangents and normals. The principal properties of their diameters, axes, foci, conjugate diameters, asymptotes, poles, and polars.

Discussion of the general equation of the second degree referred to oblique or to rectangular co-ordinate axes.

Co-ordinate Geometry of three Dimensions.—Co-ordinates of a point referred to oblique or to rectangular co-ordinate axes. Direction angles of straight lines. Inclination of two straight lines. Locus of points whose co-ordinates satisfy a given equation, or two given equations. Equations of planes and of straight lines. Determination of their inclinations, and of the conditions of their parallelism and perpendicularity. Treatment of questions concerning straight lines and planes.

Honours.

Candidates for honours will be expected to show some knowledge of the modern methods both of pure and of co-ordinate geometry, including the use of abridged methods of notation, of homogeneous point co-ordinates and line-co-ordinates, and of the modes of investigating thereby some of the simpler properties and singularities of higher plane curves.

In co-ordinate geometry of three dimensions, a knowledge of the classification and fundamental properties of surfaces of the second order will be demanded.

Sixth Stage.

Differential Calculus.—Definitions. Limits. Differential coefficients. Differentiation of simple functions, of inverse functions. Successive differentiation of functions of one variable. Taylor's and Maclaurin's Theorems and their simpler applications. Determination of values of functions when indeterminate in form. Differentiation of a function of a function and of implicit functions. Maxima and minima of functions of one independent variable.

* Though some knowledge of descriptive geometry is desirable for candidates in this stage it is not indispensable. A sufficient number of questions will be given in the remaining subjects of examination to enable a thoroughly prepared candidate to obtain the maximum number of marks independently of descriptive geometry.

Applications of the preceding to the geometry of plane curves referred to rectangular or to polar co-ordinates. Tangents, normals, sub-tangents, sub-normals, asymptotes. Multiple and singular points. Contact and curvature. Tracing of curves. Differential coefficients of arcs and areas of plane curves, and of the surfaces and volumes of solids of revolution.

INTEGRAL CALCULUS.—Meaning of definite and indefinite integration. Integration of the more frequently occurring functions. Integration by parts. Rational fractions. Formulæ of reduction.

Applications to the rectification and quadrature of plane curves referred to rectangular and polar co-ordinates, as well as to the quadrature of surfaces of revolution.

SEVENTH STAGE.

DIFFERENTIAL CALCULUS.—In addition to the subjects of the sixth stage the following:—Differentiation of functions of two or more independent variables. Lagrange's and Laplace's Theorems. Change of independent variables. Expansion of functions of more than one independent variable. Maxima and minima of such functions. Elimination of functions.

Geometrical applications of the calculus. Involutes and evolutes of plane curves. Envelopes of curves and surfaces. Tangent planes and normals to surfaces. Tangents and normal planes to curves of double curvature. Differential coefficients of the arcs of such curves, as well as of the surfaces and volumes of solids.

INTEGRAL CALCULUS.—Double and triple integrals. Applications of the calculus to the quadrature of curved surfaces and the cubature of solids. Change of variables in a multiple integral. Definite integrals; their differentiation and simpler properties.

DIFFERENTIAL EQUATIONS.—Their nature, origin, and classification. Integrable forms of differential equations of first order and degree. Integrating factors. The methods of integrating differential equations of first order, but not of first degree. Linear differential equations. Integration of them by symbolical methods when the coefficients are constant. Singular solutions of differential equations. Ordinary differential equations with more than two variables. Simultaneous differential equations. The nature and origin of partial differential equations. Integration of the simpler forms.

CALCULUS OF FINITE DIFFERENCES.—Nature and object of the calculus. Definitions of its symbols and terminology. Differences of elementary functions. Relations between successive values and differences. Differences of zero. Meaning of integration. Easy applications of the calculus to interpolation and the summation of series.

HONOURS.

In the examinations for Honours, the range of subjects will be almost the same; but the questions proposed will be of a higher order of difficulty. A knowledge of the applications of the calculus to the theory of surfaces, and of the Elementary part of the Calculus of Variations will also be demanded.

SUBJECT VI.—THEORETICAL MECHANICS.

There are two distinct nomenclatures applicable to subject VI. According to one, the science that investigates the action of force is called mechanics, and is divided into (*a*) statics, treating of the equilibrium of particles and bodies, (*b*) dynamics, treating of the motion of particles and bodies, (*c*) hydrostatics, (*d*) hydrodynamics, treating respectively of the rest and motion of fluids, *i.e.* liquids and gases. This nomenclature is adopted by many writers of authority, *e.g.* by Poisson. According to the other, the term dynamics takes the place of mechanics, and the division is into: (i) statics, (ii) kinetics, (iii) hydrostatics, (iv) hydrokinetics. This is a question of words only, but of course one terminology may be better than another. It is, however, to be observed that a considerable number of questions, formerly treated under the head of (*b*) dynamics, relate to motion without reference to the forces producing it. These questions form a distinct branch of pure mathematics to which the name of kinematics is now commonly given. Certain parts of kinematics come into Subject VI., but they occupy a subordinate position in it.

Subject VI. can be taken in two divisions, the first corresponding to (*a*) and (*b*) defined above, the second corresponding with modifications to (*c*) and (*d*). In most cases it would be best for students to take up the first stage, or even first and second stages of the first division, before attempting the second division. However, students have their choice, and to enable them to take up the second division as a separate subject, the syllabus contains several articles which also come into the first division.

In each division there is a first stage, second stage, and honour stage. The distinction between the stages is much the same in the two divisions.

In the *First Stage* the student is required to make himself acquainted with the axioms and the elementary propositions and formulæ of the science, as simple matters of fact, independently of their formal proof. For instance, he must know the proposition called the parallelogram of forces, as a matter of fact, and must be able to apply his knowledge; but he will not be required to prove the proposition. In like manner he will be required to know what is the metacentre of a floating body, but not to prove the formula for finding its position. In a word, he will be required to make brief exact statements, and to work out easy examples. With perhaps an occasional exception, the examples will be either arithmetical, or capable of being answered by an easy construction drawn to scale. No question involving complicated algebra or geometry will be set. The student should be able to substitute numerical values in an algebraical formula, and to solve a simple equation. He should also have accurate notions of ratios. Every student should bring to the examination a pair of compasses, a scale of equal parts, and a protractor.

In the *Second Stage* of either course the student will be concerned with the mathematical treatment of the principles which form the subject of the first stages respectively, so far as the subject can be discussed with the aid of what is generally called elementary mathematics. He should pay particular attention to the proofs of the mechanical propositions referred to in the synopsis of the courses. Thus, he should not merely know that when a particle moves in a circle the force acting towards the centre is given by the formula $mv^2 \div r$, but he should be able to state the reasoning by which the fact is proved, and to apply his knowledge to a moderately hard example. He should not merely know the rule for finding the magnitude of the resultant pressure of a liquid on a plane area, but be able to state the proof of it.

In the *Honours Stage* of either course it will be assumed that the student has a fair knowledge of what is commonly understood by the higher mathematics, though in drawing up the questions it will be endeavoured to exclude those which have a merely geometrical or algebraical interest.

It is of course understood that in any stage of either division any question may be asked, which fairly arises out of the contents of any previous stage. It may be added that in all stages the student should bring to the examination the drawing instruments that are necessary for the first stage.

DIVISION I.

First Stage or Elementary Course.

1. Units of time and distance; measurement of velocity, whether constant or variable; measurement of acceleration, particularly of constant acceleration; acceleration due to gravity; mass or quantity of matter, unit of mass, density, specific gravity (or specific density); momentum; measurement of force; absolute units of force, particularly the poundal or British absolute unit; distinction between the mass and the weight of a body.

2. Specification of a force. Composition of forces, particularly of two forces, whether acting along intersecting or parallel lines. Equilibrium of two or three forces. Statical couples. Moment of a force. Centre of parallel forces. Work done by a force. Units of work, foot-pound, units of power, horse-power.

3. Different states of matter. Elasticity. Resistance to (1) elongation, (2) compression, (3) bending and (4) torsion.

4. Centre of gravity, and its position in simple cases. Reaction of smooth surfaces, points, and hinges. Equilibrium of a body capable of turning on a fixed point or fulcrum. Levers; the steelyard; the balance and its sensibility. Tension of a thread. Pulleys. Equilibrium of a body resting on a smooth plane, horizontal or inclined. Stable and unstable equilibrium.

5. Laws of uniformly accelerated motion, and the formulæ embodying them, viz., $v=V+ft$, $s=Vt+\frac{1}{2}ft^2$, $v^2=V^2+2fs$. Atwood's machine.

6. Composition of two velocities. Uniform motion in a circle; centrifugal force. Small oscillations of a simple pendulum; and of a compound pendulum. Convertibility of the centres of oscillation and suspension. Determination of the numerical value of the acceleration due to gravity. Force exerted by the earth on the same mass at different places.

7. Definition of energy. Distinction between potential and kinetic energy. Absolute units of work, particularly the foot-poundal. Equation of work and energy for a constant force acting on a particle.

Second Stage or Advanced Course.

1. Relative rest and motion. Composition of velocities. Determination of the velocity of a moving point, relatively to another moving point. Angular velocity.

2. Newton's three laws of motion, and his proof of the parallelogram of forces.

3. The composition of forces—including parallel forces and couples—acting in one plane, and the conditions of their equilibrium. Centre of parallel forces.

4. Determination of the centre of gravity in ordinary cases. Properties of the centre of gravity.

5. Friction and laws of friction; co-efficient and angle of friction.

6. Equilibrium of simple machines when friction is not, and when it is, taken into account. Inclined plane, wedge, screw, pulleys. Equilibrium of body resting on axle, whether smooth or rough.

7. Virtual velocities (or virtual work). Stable and unstable equilibrium.

8. Work done by a variable force; diagrams of work in simple cases; the indicator diagram.

9. Rectilinear motion under the action of constant forces, particularly on smooth or rough inclined planes.

10. Motion of projectiles; motion in a circle; motion of a simple pendulum.

11. Impulsive forces. Direct and oblique impact of smooth spheres.

Honours Stage.

Owing to the great extent of the science of theoretical mechanics, it may be of use to the student to have those parts of the subject marked out to

which his attention should, in the first place, be directed. It cannot be too strongly urged on him that the study of the higher branches of mechanics cannot be attempted with advantage unless it is preceded by a thorough knowledge of the elements of the science. The candidate for honours should therefore be prepared to answer readily any question on the advanced course. Supposing this degree of proficiency obtained, his attention should next be directed to the subjects named below, or some of them.

It may be added that there will always be a sufficient number of questions arising out of Nos. 1, 6, 8 of the following articles, and out of Stages 1 and 2 to enable a student to obtain a second class with sound knowledge of these parts of the subjects.

1. The general theory of the composition and resolution of forces, and of the equilibrium of a rigid body. Centre of gravity.
2. Virtual velocities (or virtual work).
3. The equilibrium of flexible, inextensible threads.
4. Simpler cases of the deflection and rupture of beams.
5. The elements of uniplanar kinematics.
6. Moments and products of inertia.
7. General differential equations of the motion of a particle and of a rigid body.
8. Constrained motion of a particle; motion of a rigid body about a fixed axis, including the case when the forces are impulsive.
9. Motion in space of two dimensions.
10. The general principles of dynamics.

DIVISION II.

First Stage or Elementary Course.

The subject of Division II. cannot be understood unless the student has a preliminary acquaintance with the fundamental notions of force and motion, on which all parts of the science are based. These are given in Section 1 of the following syllabus. He should also understand what is meant by the resultant of two or more forces, and that in the case of two or more parallel forces the resultant equals the sum of the forces. He should know what is meant by the centre of gravity of a body, some of its elementary properties, and its position in the case of such bodies as sphere, prism, cylinder, circle, parallelogram.

1. Units of time and distance; measurement of velocity, whether constant or variable; measurement of acceleration, particularly of constant acceleration; acceleration due to gravity; mass or quantity of matter, unit of mass, density, specific gravity (or specific density); momentum; measurement of force; absolute units of force, particularly the poundal or British absolute unit; distinction between the mass and the weight of a body.

2. Definition of energy; distinction between potential and kinetic energy; the work done by a force; absolute units of work, particularly the foot-poundal; equation of work and energy for a constant force acting on a particle.

3. Definition of fluid and liquid; transmission of pressure through a fluid; measurement of pressure at any point of a fluid; surface of a liquid acted on by gravity, and pressure at any point within the liquid; distinction between the whole pressure and the resultant pressure of a liquid on a given surface; magnitude and line of action of resultant pressure in the case of a rectangular area, one edge of which is on the surface of the liquid; also in the case of a body wholly or partly immersed in a liquid.

4. Conditions of equilibrium of a floating body; definition of the metacentre; position of a metacentre in the case of a sphere, and of a cylinder with its axis vertical (the formula $4 \text{HM} \cdot hs = r^2$ being assumed); stability of floatation.

5. Determination of the specific gravity of insoluble solids, and of liquids (1) by the balance, (2) by the specific gravity bottle, (3) by Nicholson's hydrometer; specific gravity of solids lighter than water by the balance; weight of a body in air and in vacuo.

6. Distinction between heat and temperature; definition of higher and lower temperature, and of equal temperature; the mercurial thermometer,

and its graduation; Fahrenheit's, the centigrade and Réaumur's scales. Definition of absolute zero.

7. Air is a heavy elastic fluid; the barometer; pressure of air on the sides of a vessel containing it; variations in this pressure consequent on change of volume and temperature, *i.e.*, Boyle's Law and Dalton's Law, and the formula in which they are embodied, viz., VP=CT; limitation of Boyle's law; contents of the "vacuum-space" in barometers of different liquids.

8. Hydrometer of variable immersion; suction-pump; force-pump; siphon; air-pump and mercurial gauge; compressed air manometer; hydraulic press.

Second Stage or Advanced Course.

The demonstrations and additional subjects of the second stage require corresponding extensions in the preliminary part of the course, as mentioned below. But besides this the student should extend his knowledge of the centre of gravity, and learn how to find the moment of inertia in such simple cases as involve no more than finding the limiting value of $\Sigma_b^a (x^n \Delta x)$ by integration or otherwise, including the case in which $n = -1$.

1. Composition and resolution of forces acting on a body, and the general conditions of their equilibrium. Angular velocity. Uniform circular motion. Work done by a variable force.

2. Resultant pressure of a liquid on an immersed surface plane or curved. Centre of pressure in simple cases. Equilibrium of bodies floating freely or partly supported. Metacentre in simple cases (the formula $HM \cdot V = Ak^2$ being assumed). Tension of thin flexible cylinder or sphere under internal fluid pressure.

3. Pressure and elasticity of air; height of the homogeneous atmosphere; variations of the height due to variations of gravity and temperature; pressure of mixed gases; vapours in contact with the liquid producing them; saturation; the dew point; densities of dry and moist air. Work of gas expanding at a constant temperature.

4. Elementary notions of surface tension; rise of a liquid between two plates, and in a capillary tube.

5. Surface of a liquid in a vessel rotating steadily, under the action of gravity; pressure at any point of the liquid.

6. Velocity of liquid issuing from hole in the side of a vessel (Torricelli's Theorem); velocity of the descending surface of the fluid.

7. Elementary notions of the propagation of an aerial disturbance along a straight tube; geometrical representation of the motion of the aerial particles constituting a wave; explanation of the interference of two waves; corresponding representation and explanation by means of a sine function (*e.g.*, $A \sin(nt + \beta)$).

Honours Stage.

The parts of this course are to some extent alternative. The student will be at liberty to answer questions in any part of the paper, but it will be possible for him to obtain a first class by answering questions arising out of previous stages, and out of the first six or out of the last four of the following articles. The honours stage consists in great part of the subjects of the previous stages, but treated more generally.

1. General conditions of the equilibrium of fluids acted on by any forces.
2. Resultant pressure of a liquid on plane and curved surfaces.
3. Centre of pressure of a plane area.
4. Condition of stability of floatation in respect of small displacements.
5. Stability of floatation when the displacement is large,

6. Formula for finding distances of altitude by the barometer and the necessary corrections.

7. Sudden compression and expansion of gases; ratio of specific heat of air at constant pressure to specific heat of air at constant volume.

8. Motion of aerial waves in a straight tube; investigation and integration of the equation $\frac{d^2 z}{dt^2} = a^2 \frac{d^2 z}{dx^2}$, and interpretation of results.

9. Elements of the kinetic theory of gases.

SUBJECT VII.—APPLIED MECHANICS.*

In order to prepare for this examination the student should carefully inform himself as to the details and construction of the various contrivances, machines, and appliances, referred to in the list given below; and in doing so, he must seek to understand the manner in which certain natural laws or mechanical principles receive their useful application.

The list for the first stage is necessarily comprehensive, but the questions will be framed in such a manner that a candidate who has obtained a fair knowledge of a portion only of the subjects may hope to pass with some credit. Easy questions involving arithmetical results may arise, and in particular the student should be able to solve simple mechanical problems by graphic construction. The list for the second stage refers also to a wide range of subjects, and he will be liable to questions involving only a very limited knowledge of mathematics.

In the honours paper a fair amount of mathematical knowledge may be required.

First Stage or Elementary Course.

The subjects for examination will be:—

Measurement.—Line and end measure. Rules, callipers, gauges.

True plane Surfaces.—Surface plates. Method of surfacing. Applications in machinery.

The principle of Work and its application to simple Machines.—Levers. Balances. Safety valves. Pulleys. The snatchblock. Sheaves. The inclined plane. Screws, forms of thread, mechanical characteristics of screw threads. Right and left handed screws, single and double threaded screws. The screw and lever in combination. Screw presses. Lifting jacks. Endless screw and worm wheel. Wheel and axle, its applications. Winch or crab. Power gained by wheelwork.

The Conversion of Motion.—Endless bands, straps, fast and loose pulleys, guide pulleys. Toothed wheels. Rack and pinion. The crank and connecting rod. Cams. Mangle motions. Ratchet wheels, detents.

Special Contrivances.—Such as:—The fusee. The wheel and compound axle. Weston's pulley block. Escapements. Geneva stop. Fast and slow motion in the head stock of a lathe.

Energy.—What it means. The measure of work stored up in a raised weight or in a heavy mass in motion. The fly wheel. Fly presses.

The Pressure of Water.—Estimation of water pressure on plane surfaces, such as sluice gates. Pressure gauges. The hydrostatic press. The accumulator, or vessel for obtaining a supply of water under pressure.

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* *This syllabus has been revised.*

MACHINES FOR RAISING WATER.—Pumps. Lift pumps. Force pumps. The use of an air vessel.

MATERIALS.—Iron; qualities required for different purposes. Testing of iron for strength and ductility. Steel; hardening and tempering. Copper and tin; their alloys. Gunmetal. Brass.

STRENGTH OF MATERIALS.—Power of resistance of different materials to tensile and compressive stresses. Power of resistance to forces acting transversely. Influence of form or dimensions of section. Influence of length, of position of load, of distribution of load.

FRICTION.—The laws of friction. Contrivances for lessening the effect of friction.

In answering the questions, students will be required to make hand sketches of the details of the various parts in a clear and intelligible manner. Great importance will be attached to this requirement.

SECOND STAGE OR ADVANCED COURSE.

The subjects for examination will include everything mentioned in the first course, but candidates will be expected to possess a more extended and thorough knowledge of the various details, as well as of theoretical principles. The additional matter will be the following:—

MISCELLANEOUS DETAILS.—The forging of iron. Welding. The casting of iron. Moulding. Soldering. Brazing. The expansion and contraction of metals.

FRICTION.—Examples where friction is useful. Rolling friction. Brakes. Strap-brakes. Friction, and other dynamometers. The efficiency of machines. Friction grips. Holding power of ropes when coiled. Friction clutches.

STRENGTH OF MATERIALS.—Estimation of stresses in a rectangular timber beam. Cast and wrought iron girders. Cantilevers. Buckle plates. The deflection of beams.

STRESSES IN FRAMEWORK.—Simple examples of framework, with corresponding diagrams of stress. Travellers, roofs. Lattice girders. Trusse beams.

SHEARING STRESSES.—Cotters, rivets, joints of plates. Strength of shafting to resist torsion. Hollow or solid shafting.

COMPRESSIVE STRESS.—Pillars. Piers. T and angle iron struts. Tie bars.

THE CONVERSION OF MOTION.—Quick return movements. Linkwork and parallel motions. Peaucellier's invention. Trains of wheels for screw-cutting, clockwork. Epicyclic trains. Rope-making machinery. Differential motion of three bevil wheels. Universal joints.

PRESSURE OF AIR.—Fans, blowers. Air pumps. Gauges for measuring the pressure of air. Construction and efficiency of wind-mills. The diving bell.

HYDRAULIC MACHINES.—Water wheels. Forms of buckets. Pendulum Governor for water wheels. Turbines. Centrifugal pumps. Hydraulic press. The hydraulic jack. Hydraulic cranes, different powers. Force pump for feeding the accumulator. The water ram.

DESCRIPTION OF MACHINES IN COMMON USE.—Such as:—Cranes. Machines for weighing. Counting and numbering machines. Corn mills. Clocks. Dead beat escapement. The lever escapement. The chronometer escapement. The keyless watch. Hand-printing presses.

PRINCIPLES AND CONSTRUCTION OF HAND TOOLS.—Such as:—Chisels. Planes. Gimlets. Augurs. Saws. Drills. Files.

MACHINE TOOLS.—Such as:—Lathes, ordinary and screw cutting. Planing, shaping, and slotting machines. Reversing motions. Drilling and boring machines. Punching and shearing machines. Feed motions.

The observations already made with reference to hand sketching apply equally here, and details of machines, such as feed motions, reversing motions, &c., might form the subject of questions, the answers to which will be of no value unless the sketches are correctly given.

Honours.

The above syllabus will sufficiently indicate the nature of the subjects that form the basis for the examination in honours. Candidates must be versed in mechanical principles, and will be asked to give theoretical investigations which may bear upon the subject matter under consideration.

ELEMENTARY PHYSICS.

An Alternative for the First or Elementary Stage of Subjects VIII. and IX.

The following is an alternative syllabus for Stage I. of Science Subjects VIII. and IX., and is intended for those students who do not propose to continue their studies further in these branches of Science, but to whom an elementary knowledge of Physics is necessary to enable them to pursue their studies in other subjects with advantage.

The student's success in Elementary Physics will be registered as a success in the Elementary stages of Subjects VIII. and IX., and no second payment will be made on account of the same class in either subject at a future examination.

A paper will be set in this syllabus at the examination on the 10th May 1894, and a candidate may on that date take either it or the paper in the ordinary elementary syllabus of Subject IX.; but no candidate may be examined in the syllabus of the ordinary elementary stage of Subject IX., or of Subject VIII. on the 11th May, and also in this alternative syllabus.

All the experiments given in the list, except thus between square brackets [ ], must be shown to the class, and candidates will be expected to show a knowledge of the subject such as might reasonably be expected from those who had attended a course illustrated in accordance with the suggestions of this syllabus. The experiments described between square brackets [ ] will be found useful where the necessary apparatus can be provided.

SOUND.

Cause of Sound.

Sound produced by vibration. (1.)

Illustration.

1. Exhibit vibrating tuning fork and string.

Propagation of Sound.

Sound transmitted through solids, liquids, and gases. Study more particularly air. (2, 3.)

Air particles have only vibratory motions. (4.)
Sound wave consists of alternate compressions and rarefactions. (5, 6, 7.)
Wave length. Amplitude of vibration.

Experiments and Illustrations.

2. Strike a tuning fork and hold its root on one end of a deal rod, and place a board on and off the other end. This will show that the sound travels along the rod.

[3. A glass tube about 18 in. long and ½ in. wide, closed at one end, is fastened perpendicularly by wax to a square thin deal board (not cracked), about 2 ft. square. Support the board on three corks. Fill tube with water. Strike fork armed with cork cone, and plunge cone into water at top of tube. The sound heard shows the wave travels through the water.]

4. Show that water waves do not carry floating matter with them.

[5. Arrange "solitaire" balls or marbles in a groove, and hit the row with one, two, or three, noticing the number which are sent off from the other end.]

[6. Coil a long steel wire into a helix about 4 in. in diameter and 6 ft. long when the coils are about one-third of an inch apart. Suspend from two parallel wooden rods, every tenth or twelfth coil being hooked to two threads, one of which is attached to each rod so that the whole helix is horizontal and parallel to the rods. Gather a few coils at one end into the hand, and on releasing them observe the compression travel to the other end of the wire.]

7. Fasten one end of a caoutchouc tube about ¼ in. wide and 12 ft. long, and filled with sand, to the ceiling. Fasten a piece of paper near the top. Send a wave of rarefaction up the tube by quickly pulling the free end.

Velocity of Sound in Air.

Velocity greater in warm than in cold air.
High and low notes travel with the same velocity.

Reflection of Sound Waves.

Angles of incidence and reflection equal. (8, 9.)
Echoes. Whispering galleries.
Speaking trumpet.

Experiments and Illustrations.

8. Two tinned iron tubes, each about 3 ft. long and 4 in. in diameter, are fitted end to end. A watch is placed at such a distance from the ear as to be inaudible. The tube is placed over the ear and directed towards the watch. The ticking becomes audible.

9. The tubes are supported horizontally at an angle of 90° with one another. A watch is placed at the end of one, and the ear at the end of the other (the ends furthest apart), and screens are placed between the ear and the watch till the latter becomes inaudible. A piece of cardboard or the hand or a flat flame is placed at their contiguous ends, making 45° with each tube. This makes the watch audible and proves the law of reflection.

[This experiment may be better demonstrated if the watch is replaced by a small reed blown by compressed air, and the ear by a sensitive flame.]

Cause of Differences of Loudness and Pitch in Two Musical Notes.

The pitch of the note rises through an octave when the number of vibrations is doubled. (10.)

Transverse vibrations of strings.

The note rises when a string is shortened or stretched more tightly than before. (11, 12, 13, 14.)

Experiments and Illustrations.

10. A large humming top with a smooth button driven into its peg is filled with sand and closed. Resting upon the body of the top and fastened to it is a horizontal disc of thin iron plate, having 200 or 300 teeth in its circumference, and also two rings of holes near the circumference. One ring has twice as many holes as the other. A piece of quill glass tubing is bent to 135° at one end.

The humming top is spun on a hard surface. A card is held against the toothed wheel. A note is produced, which becomes lower in pitch as the top moves slower. Air is blown through the tube on to the outer and on to the inner ring of holes. The note produced by the former is always an octave higher than that by the latter.

11. To show that the rate of vibration of a stretched string varies inversely as its length, other things being the same, fasten two similar iron wires to the wood-screws of a monochord. Pass the other ends over the brass pullies and fasten equal weights to them, say 28 lbs., using the whole lengths of the wires from the fixed bridge to the pullies. Pluck the wires in the middle, and the same notes will be given. Insert a bridge half way between the one pulley and the bridge under one wire, the shortened wire gives the octave higher than the unshortened wire. Insert bridge anywhere in the other string. Make one string half as long as the other, and the shorter string always gives the higher octave or twice as many vibrations in a second as the longer one.

12. To show that the number of vibrations increases with the stretching force or weight, fasten two weights over the pullies and let one weight be four times as great as the other. The wire with the heavier weight gives the octave higher than the one with the lighter weight. And this is the case if the bridges are inserted anywhere, provided the two are at the same distance from the pullies.

13. Combine results of the last two experiments. That is, hang any two unequal weights from similar wire over the pullies, and use the whole length of the more weighted wire; shift the bridge of the less weighted wire till the two give the same note. It is then found that if the wire A has the greater length it is stretched by the greater weight.

[14. Show that, other things being the same, the number of vibrations varies inversely with the thickness of the wire. Obtain the relative thicknesses of two iron wires; vary the weights which stretch equal lengths till there is unison. Then prove that the thicker wire is stretched by the greater weight.]

LIGHT.

Propagation in straight Lines.

Shadows. (15.)
Images formed by pin-holes. (16, 17.)
Decrease of illumination with distance.
Law of inverse square. (18, 19.)
Simple photometers. (20.)

Experiments and Illustrations.

15. Place a stick vertically between the wall and a long thin luminous gas flame. Notice that the shadow of the stick is sharply defined. Place stick or flame horizontally. Show penumbra.

16. A pin-hole camera should be made as follows. Make two pasteboard tubes by rolling pasted paper on a wooden cylinder, so that one fits inside the other. For the wider tube, previously cover the cylinder with dry paper. Cover one end of the wide tube with tinfoil, and make a pin-hole in the middle. Cover one end of the narrower tube with tissue paper, and thrust this end in the wider tube. Line with black paper. Notice pictures on the tissue paper.

[17. Cover a lantern cap with tinfoil, remove the condensing lens, and place the cap on. Make pin-holes in the cap. For every pin-hole there is an image formed on the screen. Make the pin-holes more and more numerous, and near together, till the images overlap and become confused. At last diffused light is produced, which is an overlapping of images.]

18. Make a tall rectangular pyramid of wire. Stretch across the base three threads at equal distances parallel to one side, and three parallel to the adjacent side, so as to divide the base into 16 squares. Fasten a square of wire around the pyramid half-way up, and tie two threads across it, bisecting the sides, thus forming four squares. At a quarter distance from the top fasten a square around. All the squares are equal.

19. Fasten a square of wire in a clamp, and place it in an otherwise dark room, half way between a candle and the wall. Cut a square sheet of paper so as just to cover the shadow of the frame. Fold it across and across, and it will fit the frame itself.

20. Shadow Photometer.—Place an opaque rod of not less than 1 in. diameter vertically at about 3 feet from a white screen. Place a candle about 2 feet further off nearly in the plane through the rod perpendicular to the screen. Place another candle so near the first that the two shadows are close together. Move one candle to and fro till the shadows of are equal depth, that is, are equally illuminated. The brighter light will be furthest off. The illuminating powers are in the proportion of the squares of the respective distances from the screen. Confirm this by making a cluster of two or three candles close together at one place, and using a single candle of the same brightness at the other.

Reflection.

Laws of reflection. (21, 22, 23.)
Position and nature of images formed by plane mirror.

Experiments and Illustrations.

[21. Fasten a little whitened wooden stick with wax perpendicularly at the centre of a plane looking-glass. Cast upon the mirror at the foot of the rod a beam of parallel rays from the lantern or a sunbeam coming through a hole in a screen. Notice (*a*) that the reflected beam always makes the same angles with the mirror and the stick as the incident beam does, and (*b*) that the incident beam, the stick, and the reflected beam all lie in one plane.]

22. At one end of a piece of board 1 ft. long by 4 in. wide fasten by sealing wax a cork upright, through this pass horizontally a piece of glass tube about 2 in. long and ¼ in. internal diameter. Stretch a vertical thread across the opening of the tube nearest the other end of the board. Towards the other end on the same side fasten a circular sheet of cardboard divided into degrees, the 0° being nearest to the tube and in the middle of the board. Pivot in the centre of the circle two radial arms one above the other, one carrying at its end a vertical pin, the other a central mark. The second carries a 2 in. square piece of silvered glass

in a vertical plane perpendicular to the arm. The pin bearing arm being placed anywhere, the mirror bearing arm is turned till the reflexion of the pin is seen and coincides with the thread in the tube. Whenever this is the case, the reading of degrees where the pin is always twice as great as where the marked arm is.

23. Refer to reflection from surface of still water and reflection after sunset from elevated clouds.

Simple refraction and Images.

A ray of light passing from a less dense to a more dense medium is bent towards the perpendicular to the separating surface and conversely. (24, 25, 26, 27.)

Formation of images (1) by concave mirror, (2) by convex lens. (28, 29, 30, 31.)

Burning-glass.

Experiments and Illustrations.

24. Place a coin at the bottom of a basin and place the basin so that the coin is hidden by the edge. Pour in water till the coin becomes visible.

[25. Stretch a wire across opening in cap of lantern. Focus shadow of wire on screen. Interpose strip of glass in front of wire and tilt the strip. Notice displacement of part of shadow.]

[26. Focus on the screen a small circular hole in the cap of the lantern. Introduce wedge of glass and show that the spot is moved towards the base of the wedge. Let the first face of the wedge be oblique to the beam. Put the second wedge with the first, face to face and base to base, so as to form a single wedge of double the angle. Notice the double displacement of the light spot. Put them edge to base; notice the emergent beam is parallel to the incident.]

[27. Place a glass cell before the lantern and focus it on the screen. Let the surface of the water be visible. Add a lump of ice on the water, observe the streaky appearance of the illuminated part of the screen. Add syrup, alcohol, and hot water, by a pipette. Pour the vapour of ether out of a bottle. Examine shadow of burning gas, red-hot poker, and platinum wire, through which a current of electricity is passing.]

28. Show in an otherwise dark room that if a candle is at 20 feet distance from a concave spherical mirror the light will be focussed to a point half way between the centre of the mirror and its centre of curvature. Catch the light so focussed on a small paper screen.

29. Advance distant candle flame towards the mirror, move it up or down. Show that the focus advances to meet the light and that when the light is raised the focus is depressed, and conversely. Show that when the candle flame is at the centre of curvature there also is the focus. When the flame is between the centre of curvature and the principal focus the focus of the flame is further away than the principal focus. When the flame is in the principal focus the reflected rays are parallel, or the focus is at an infinite distance. When the flame is still nearer the reflected rays diverge, so that they cannot be caught on a screen, but appear to come from a point behind the mirror. Repeat all these with a fish-tail burner, and notice the inversion of the image in all cases but the last. Notice that in all cases where a real image is formed the flame and the image may change places.

30. Determine principal focus of a double convex or plano-convex lens. This is done by measuring distance from lens where the focus of a distant point or image of a distant body, say, sun or moon, is formed with a lens.

31. Make a series of experiments similar to those with concave mirror, that is, examine image of fish-tail burner when the burner is 20 feet off. Catch the image (close to the principal focus) on a screen on the other

side of the lens. Notice the image is smaller than the flame and inverted. Advance the burner towards the lens. Observe the image grow in size, and retreat from the lens. When the flame and its image are of equal size they are equidistant from the lens (this corresponds with the flame and image, both being in the centre of curvature of the concave mirror). Advance the flame nearer; the image increases and retreats. When the flame reaches the principal focus the refracted rays are parallel, or the focus is at an infinite distance. Nearer yet, the rays after refraction diverge, and would meet if produced on the same side of the lens as the flame. Hence deduce magnifying property of common lens when held near the eye or near an object. Show that the image and object may always change places if there is a real image. Being on the same side of the lens as a real image, magnify the image by a hand lens.

Explain astronomical refracting telescope.

General notions as to the composite character of white Light. (32, 33, 34, 35, 36.)

Decomposition of white light and its recomposition, colour of objects.

Experiments and Illustrations.

32. Paint disc of cardboard in segments of violet, blue, green, yellow, orange, and red: fasten it on a top and spin. Notice the blending of the colours by retention of images into a grey.

[33. Make a solution of sulphate of copper, 2 of sulphate to 20 of water. Add ammonia till the precipitate is re-dissolved. Place solution in glass cell. Focus a round hole in lantern cut on screen. Interpose above solution. Notice pure blue colour. Interpose red glass either before or after the cell. Notice total extinction of light.]

[34. Paint sheets of cardboard with various brilliant colours. Send the light in an otherwise dark room upon these, and catch reflected light on white sheets of cardboard.]

[35. Use the bisulphide prism to produce a long spectrum of a slit on lantern cap. Pass through the spectrum (*a*) the glass cell containing as many coloured transparent solutions as you have. Notice the shadow of the cell. Pass through the same spectrum various coloured opaque bodies, such as flowers.]

36. Take a strip of white paper about $\frac{1}{16}$ inch wide and 2 inches long, place on a sheet of black paper, and view it through a prism (a common chandelier drop will answer). Notice that a spectrum is produced. In the prolongation of the white strip place a similar strip of coloured paper, and notice the absence or faintness of some of the colours of the spectrum. Sprinkle salt on the wick of the spirit lamp; view flowers and other coloured opaque bodies by this light.

HEAT.

Distinction between Heat and Temperature.

Difficulty of estimating the temperature of substance by touching it. (37, 38.)

Construction of mercurial thermometers. (39, 40.)

Fahrenheit and Centigrade scales.

Expansion:

Of solids—

Expansibility different for different substances. (41, 42, 43.)

Force necessary to resist expansion or contraction. (49.)

Of liquids—

Unequal expansion of liquids. (44.)

Contraction and expansion of water when heated. (50.)

Importance of these facts. Temperature of water in lakes above the ice-point when ice is forming on the surface.

Of gases—

Expansion of air. (45, 46, 47, 48.)

Experiments and Illustrations.

37. Mix hot and cold water. No heat is added or subtracted, but the temperature of the mixture is different from the temperature of the two masses of water before mixture.

38. Plunge one hand into hot water, the other into ice-cold water. Plunge both into lukewarm water. Notice that the cooled hand feels warm, and the warmed hand cool.

39. Illustrate method of filling thermometer bulb and determining fixed points.

40. Place thermometer amongst pieces of melting ice. Also in boiling water. Note the temperature 0° C. and 100° C. (32° F. and 212° F.). Add a little salt to the ice and to the water; note again.

[41. Cut a round hole in a sheet of tin plate exactly large enough to let a round-bottomed 4 oz. flask pass through. Fill the flask with boiling water; it will not pass through till the plate has got warm. Stretch a long piece of platinum wire between metallic supports. Heat it by means of a galvanic current. It becomes slack.]

42. Solder together side by side a brass and iron wire, each about 2 feet long. Hammer the compound wire straight, and notice how it bends when heated. Fuse a piece of platinum wire through the side of a glass tube, and notice that the glass does not crack on cooling.

43. Refer to (1) cracking of thick glass vessels when boiling water is poured into them, (2) necessity for leaving an interval between the ends of consecutive rails on railways.

44. Fit with corks the necks of the three 4 oz. flasks. Fit tightly into the corks three narrow glass tubes open at both ends. Fill the flasks with water, alcohol, and oil of turpentine respectively. Push in the corks till the liquid stands in each at the same height. Put all three to the same depth into a vessel of warm water. Notice that the expansion of the glass causes a momentary sinking of the liquids; that ultimately the expansions are very different.

45. Fit a 2 oz. flask with a tight cork through which a tube passes, the other end of which is bent down and then up at the end. Clamp the flask so that the end of the tube dips under water in a basin. Fill a test tube with water, and invert it over the end of the tube. Warm the air in the flask, and collect the expelled air in the test tube.

46. Fit tightly a cork through which a straight tube passes into the neck of a 2 oz. flask. Turn over and pass the tube through the cork in the neck of a wide-mouthed bottle containing coloured water. Warm the flask with the hand so as to expel some of the air, and let the liquid rise in the stem. (An air thermometer.)

47. Fasten two such flasks together air-tight by a tube bent six times at right angles and containing some coloured liquid in the middle bend. Show that the liquid moves if one flask is warmed more than the other.

[48. Fit corks and bent tubes into two flasks as in 45. Fill one tube with air, and the other with coal gas. Cover equally in the same vessel with hot water. Collect expelled gas in two test tubes full of water. Show that the quantities driven out are nearly equal.]

[49. Place a hermetically sealed and filled tube of water in a basin, cover it with a cloth, and pour hot water on it. Notice it burst.]

[50. Cool a flask in melting ice; fill it full with ice-water (the water from melting ice), fit in cork with tube, well fitting till liquor stands in

tube. Allow to get warm. Notice shrinking followed by expansion. Repeat the experiment, and observe the temperature of the water when its volume is least; show that the temperature is + 4° C. (39·2° F.).]

Capacity for Heat.

Unequal capacity of different bodies for heat. (51, 52, 53, 54.)
Influence of high capacity for heat of water on the climate of the British Isles.

Experiments and Illustrations.

51. Heat equal weights of lead and water in the same beaker. Provide two other beakers containing equal weights of cold water. Put the hot lead into one of these, the hot water into the other. Stir and note the temperatures.

52. Show similarly that 1 lb. of water which was at the atmospheric temperature, and has been heated by contact with 1 lb. of iron at 100°, is not so hot as the 1 lb. of water which was at 100° and has been cooled by contact with 1 lb. of iron at the atmospheric temperature. [Pour the water in the two cases into beaker glasses, and plunge in the two air thermometer bulbs, if a differential air thermometer can be used.]

[53. Shake up known weights at known but different temperatures of water and mercury, water and turpentine. Confirm by shaking up mercury and turpentine. The relative capacities for heat are inversely as the weights, and inversely as the range of change of temperature.]

54. Heat equally (to about 150° C.) in an oil bath cylinders of different metals fastened to thin wires. Lay them simultaneously on a cake of beeswax ¼ inch thick on retort stand. Notice the order of falling through of those which do so, and the depth to which the others sink.

Change of State.

Many solids change into liquids, and liquids into gases, at definite temperatures. (55, 56, 57.)
Note exceptions, such as pitch, mixtures of different liquids, &c.
During the change of state heat is absorbed without rise of temperature. This called latent heat. (58, 59, 60, 61.)
Influence of pressure on the boiling point of water. (62, 63.)
Heights can be determined by observation of the boiling point.

Experiments and Illustrations.

55. Put large water thermometers into mixture of melting ice and water at 0° C., and into boiling water. Note that the temperatures are fixed.

56. Notice that ice floats in water. Soften and blow a small bulb on the end of a glass tube. Fill the bulb with water, seal in the gas flame, and put it in a mixture of ice and salt. Observe bulb burst.

57. Fill a flask with mixture of ice and water, fit in neck well-fitting cork with long narrow tube till water stands at a certain height in tube. Observe how it sinks as the ice melts.

58. Put some ice into a known weight of hot water. Notice the temperature when the ice is melted. Determine the weight of the ice by reweighing the water. Point out that a small quantity of ice requires a large quantity of heat to melt it. Explain the slow melting of snow after a thaw has set in.

59. Pass steam, produced by heating water in a flask, through a delivery tube into cold water. Notice the rapid rise in temperature, and determine the weight of water condensed.

60. Place a few drops of water between the bottom of a small beaker and a block of wood. Put some ether into the beaker and blow over it with a pair of bellows having a tube fastened to the nozzle. The water will freeze.

61. Notice the liberation of heat when a cold body condenses the steam from a kettle.

62. Get a very well-fitting, soft, long, and sound cork to fit the neck of a 4-oz. round-bottomed flask. Boil water in the flask till all the air is expelled. Remove burner, and cork up the flask as nearly at the same instant as possible. Turn the flask over and pour cold water on the top. Also immerse the corked flask in cold water, and observe in both cases the ebulition under diminished pressure.

[63. Connect flask containing hot water with the air pump. Show that the water begins to boil when the pressure is reduced. Use an intermediate flask to prevent water vapour from passing into the interior of the pump.]

Conduction and Convection.

Conduction in solids and fluids. (64, 65, 66, 67, 68, 69, 70, 71.)
Convection in fluids. (72, 73.)

Experiments and Illustrations.

64. Wrap a piece of paper smoothly around a brass tube and hold in air-gas burner. The paper is not scorched. Wrap the paper around a wooden rod of the same size, and heat; the paper is scorched.

65. Twist an iron and a copper wire together at one end. At about 4 inches from the joint fasten a marble on each with beeswax. Heat the joint in an air-gas flame. Notice that the marble on the copper is the first to fall.

[66. Place a cylinder of metal on an air thermometer. Notice height of liquid in stem. Heat a copper cylinder in boiling water, dry it, and place it on the first cylinder. Wait two minutes. Note the depression. Remove the cylinder and restore the temperature. Perform the same experiment with other metal cylinders, always using the same copper one as a heater. Notice the difference of depression with different metals. Cut cylinders of wood, cork, &c. and show that they arrest nearly all the heat.]

67. Make a short coil of stout copper wire, $\frac{1}{4}$ inch internal diameter. Pass it over the wick of a candle without touching the wick. The candle is extinguished.

68. Turn on, but do not light, a gas jet. Hold over it a wire gauze and light the gas above the gauze. Notice that the flame does not strike through. Principle of Davy lamp.

69. Put a piece of ice in the bottom of a long test tube, weight it down with a piece of lead. Add water above. Hold obliquely and boil the water over an air gas or spirit lamp flame without melting the ice.

70. Examine shadow of red-hot poker. Notice that the heating of the air as exhibited by its refraction extends a very little way downwards, showing the air is a bad conductor.

71. Place a little lime in the palm of the hand and bring the point of the hot poker upon it. The air amongst the lime refuses to conduct, and the hand is not burnt.

72. Heat over a small flame a round-bottomed flask full of water. Throw into the water some solid colouring matter, like cochineal, aniline dye, litmus, &c. Notice how the hot and coloured water ascends.

73. Fasten the end of a candle on to a plate and light it; surround the candle with water. Place over the candle a cylindrical glass shade. Notice the extinction of the candle. Repeat the experiment and introduce down the centre of the cylinder a cardboard diaphragm.

Notice that the candle continues to burn. Hold some smouldering brown paper near one side of the cardboard, and notice the direction in which the smoke moves.

MAGNETISM.

Principal properties of Magnets.

Attraction of iron by magnet. (74, 75.)
In case of long thin magnets iron attracted chiefly by ends. Poles. (76.)
Direction assumed by magnet which can move freely in a horizontal plane. Mariner's compass.
Magnetic meridian. (77.)
Difference between the poles. Names of poles. Mutual behaviour of like and unlike poles. (78.)
Soft iron under the influence of a magnet is itself magnetised.
Soft iron is magnetised easily, but temporarily. (80, 81, 82.)
Steel with difficulty, but permanently. (83, 84.)
The magnet points north and south, because the earth is a magnet, the poles of which are near to the geographical pole. (85.)
Dipping needle. (86, 87.)

Experiments.

74. Exhibit two pieces of steel, one magnetised, the other unmagnetised. Show that one does, and the other does not, attract iron.

75. Neither attracts sawdust.

76. Iron filings collect chiefly at the ends of a magnetised knitting needle and equally at both ends.

77. Attach a magnet and small rod of iron and wood to three corks; float each in turn in a basin of water, and prove that the magnet alone tends to set itself N. and S.

78. Suspend two magnets and a rod of iron so that they can move in a horizontal plane. Mark the north-seeking ends. Dismount one of the magnets, and observe the effects when the poles are in turn brought near the two ends of the magnets and iron rod.

79. Hold one end of a bar of soft iron in iron filings and bring a magnet near to the other end. Repeat with wood instead of soft iron.

80. Hold a bar of soft iron and a magnet in a straight line, and test by another magnet the nature of the pole produced at the extremity of the iron farthest from the magnet.

[81. Hang a number of iron wires of equal length from one pole of a magnet and observe how the other ends repel one another.]

82. Hang by a silk fibre a soft iron nail horizontally over the poles of a horseshoe magnet standing on its bend in a vertical plane. Bring pole of another magnet near one end of nail, and obtain repulsion if the pole of the moveable magnet is of the opposite kind to that of the fixed one.

83. Repeat with magnet reversed. Repeat with hard steel substituted for soft iron. Magnetic chain.

84. Magnetise steel knitting needles by single touch. Prove that the end last touched is a pole of opposite name to the touching pole.

85. Hold a strong magnet under a magnet which can turn in a horizontal plane. Show that the latter takes up a position in which its poles point to those of the former.

86. Fasten firmly with hot shellac a silk fibre to the middle of a piece of unmagnetised knitting needle. File off one end till the needle hangs horizontally. Magnetise it, and notice the dip.

[87. Hold a poker in the magnetic dip, and in the magnetic meridian, that is, parallel to the magnetic axis of the earth. Hit its upper end with a hammer and show that it becomes magnetic in such a manner that its N. seeking end is downwards, and towards the north. This shows that the magnetism at the north geographic pole is south seeking.]

ELECTRICITY.

Instruments for Detecting Electrification.

Pith balls. Balanced rods. Gold-leaf electroscope.

Electrification.

Electrification by friction. (88 to 95.)

Experiments and Illustrations.

88. Balance a lath upon the inverted bottom of a round flask which may stand on its neck, or the neck may be placed in or over the neck of a wine bottle.

Rub smooth face of resin on hot dried flannel, and hold to one end of lath. Notice approach.

89. Rub a dry and hot sheet of brown paper with a clothes brush, fold it up and bring it towards the lath. Notice approach.

90. Heat mahogany board and heat foreign-post paper; rub the paper on the board with a piece of india-rubber. Pick the paper off. Notice crackling and sparks in dark room. Lay it on other side of board, also on wall. Notice how it clings: also attracts the lath.

91. Arm two fingers with pieces of vulcanized caoutchouc tubing. Draw silk ribbon between. Observe the ribbon cling to wall, also that it attracts the lath. [Draw collodion film between dry fingers, and observe attraction to lath.]

92. [Spread amalgam upon silk rubber, warm thoroughly, and use while warm. Close one end of thick glass tube 2 feet long. Heat thoroughly. Rub amalgamed silk on glass till crackling is heard. Show how electrified glass attracts feathers, gold leaf, lath, &c. The silk rubbers improve very much by use.]

93. Rub stick of shellac with dry flannel, and repeat on substances used in last experiment.

94. Rub stick of sulphur and repeat.

95. [Excite glass with amalgamed silk, also sealing-wax with flannel, and place each in succession on wire stirrup, and hang up by thread. Notice how each moves towards the hand when held near.]

Two kinds of Electrification.

Positive and negative or vitreous and resinous electricity. (96 to 100.)

Experiments and Illustrations.

96. Show that shellac or sealing-wax rubbed with flannel is attracted by glass rubbed with amalgamed silk.

[97. Show that sealing-wax rubbed with flannel is repelled by sealing-wax rubbed with flannel (one piece on wire stirrup), and that glass rubbed with amalgamed silk is repelled by glass rubbed with amalgamed silk. Show that sulphur rubbed with flannel is repelled by wax rubbed with flannel.]

98. Excite thin sheet of writing paper on hot mahogany board with a piece of india-rubber. Cut it into strips as it lies with a sharp knife, leaving a band at one end, hang it from a thread fastened to a bent pin. Notice now the strips repel one another. Bring near them a glass rod excited with amalgamed silk. Observe general repulsion. Observe attraction to excited sealing-wax.

99. Touch top of electroscope with excited sealing-wax, sulphur, glass, &c., in succession, and observe increased divergence or collapse of leaves.

100. Heat glass very hot, rub with fur, and notice that the glass acquires the same kind of electricity as sealing-wax rubbed with flannel.

Difference between Conductors and Insulators.

Distinction between good and bad conductors and insulators. (101 to 104.)

Experiments and Illustrations.

101. Fasten one end of a fine copper wire, five yards long, through the hole in the electroscope; make a loop at the other end, place the loop over a glass tube, and having excited the tube with amalgamed silk, let the loop slide along the tube. Notice divergence of leaves. Use sealing-wax and flannel as above. Also replace wire by cotton thread, dry silk thread, and wet silk thread. Show that the earth is a conductor.

[102. Make insulating stool. Varnish four strong glass tumblers. Place on the top the mahogany board.]

[103. Stand on stool, touch electroscope with finger. Let the coat be struck by another person with a fur skin.]

104. Paste tin-foil or Dutch metal on both sides of cardboard. Cut out round discs of various diameters and fasten on to ends of sticks of shellac or thin varnished glass tubes. Show the use of these as proof planes.

Simultaneous and equal Production of two kinds of Electrification. (105.)

Experiment.

105. Rub sealing-wax with flannel wrapped round it. Place the two on the top of the electroscope. Notice that at first there is no effect but the leaves diverge when the sealing-wax is withdrawn from the flannel.

Induction.

Effect of electrified bodies on unelectrified conductors. (106–110.)

Experiments and Illustrations.

106. Use proof plane by touching electrically excited bodies, and then, touch the electroscope, determine which are $+^{ly}$ and which $-^{ly}$ electrified. Show that the proof plane when neutral will cause a partial collapse of the leaves however excited: that when electrified with the opposite kind the proof plane may also produce partial collapse, total collapse, or the latter followed by divergence.

107. Bring electrically excited body near to electroscope. Observe divergence of leaves; followed by collapse on withdrawal.

108. Put the hand on electroscope. Approach $\pm$ electrified body. Then remove the hand. Then remove the electrified body. Notice that the leaves diverge with $\mp$ electricity.

109. Place two insulated conducting balls in contact with one another. Bring excited glass near one, remove the other, then the glass. Show that the ball nearest to the glass has $-^{ve}$, the other $+^{ve}$. Show the converse with shellac.

110. Bring the excited glass near one side of an insulated ball; touch the side nearest to glass with proof plane. Show that the plane becomes $-^{ve}$. Touch other side; show that the plane becomes $+^{ve}$. Touch the ball momentarily anywhere with the hand: then remove the glass and show that the whole ball is $-^{ve}$. The converse with shellac.

Simple Explanation of Frictional Electrical Machine.

Potential.

Simple explanation of bodies being at different electrical potential if electricity passes between them when they are put in conducting communication. Analogies with temperature and level.

If copper wires are attached to plates of Zn and Cn immersed in dilute acid, they are at different potentials. If the wires are connected an electrical current passes round the circuit. Work is done not by a machine, but by chemical action. Direction of flow of positive electricity.

An Electric Current.

(1.) Heats the conductor in which it is flowing. (111.)

(2.) If the conductor is acidified water it is broken up into its chemical constituents. (112.)

If a metallic salt is dissolved in the water the current may deposit the metal on the plate or wire by which the current leaves the liquid. (113.)

(3.) A magnet in the neighbourhood of an electric current tends to set itself at right angles to the direction in which the current is flowing. (114, 115.)

(4.) A coiled conductor in which a current is passing behaves as a magnet and magnetises a bar of soft iron placed within it.

Experiments and Illustrations.

111. Exhibit glowing platinum wire spiral.

112. Exhibit electrolysis of acidulated water.

113. Electrolyse various solutions of metallic salts (*e.g.*, sulphate of copper, nitrate of silver, sulphate of iron, acetate of lead, &c., avoiding chlorides), show that the metal separates at the $-^{ve}$ pole.

114. Suspend a magnet over a wire, running north and south, whose ends are connected with the poles of a battery. Notice that the needle is deflected and note the direction. Note also that the direction of inflection is reversed if the wire be above the needle.

[115. Principles of telegraphy.]

116. Wrap covered copper wire round a poker from end to end in a right-handed spiral, and attach ends to battery. Examine polarity of poker, keeping connexions with battery the same, reverse the spiral. Reverse in both cases the battery connexions. Examine polarity in each case. Wrap the wire round the poker continuously from end to end and back again. Again examine polarity.

117. Make an electro-magnet out of a horse-shoe.

[118. Wrap a covered copper wire into a helix, bring the ends round inside the helix to the middle, then through the helix and through a flat cork. On one end fasten a piece of zinc and on the other a piece of copper. Float the whole on dilute sulphuric acid (1 : 12). Show that the coil floats N. and S. and that one end is attracted and the other repelled by the N. end of a magnet. Deduce from this that the polarity of the coil is the same as that of the induced magnet inside. Confirm this by examining the polarity of the coil of 61 and the polarity of a rod of iron placed inside it.]

119. Construction of simple form of electric bell.

SUBJECT VIII.—SOUND, LIGHT AND HEAT.

Candidates in the first stage must take it as a whole, and will be expected to answer questions in Sound, and in Light, and in Heat.

In the second stage, and in the examination for honours, the subject will be taken in three sub-divisions, and a candidate will be allowed to take up one or more of the sub-divisions, viz., Sound, Light, or Heat, in the same or in different years. But no candidate may offer himself for the honours examination in any subdivision unless he has passed the second or advanced stage in that subdivision.

It must be distinctly understood that candidates when answering questions on the explanation of physical phenomena are expected to be acquainted with the mechanical principles on which these explanations are based, and also that problems may be set involving a knowledge of the facts or formulæ referred to in the syllabus.

NOTE.—An outline of elementary experiments, together with a description of the necessary apparatus, for illustrating this subject has been prepared; this (Price 6*d.*) and a syllabus of the course of practical instruction in Physics at the Royal College of Science, South Kensington (Price 1*s.*), may be obtained on application to the Department. [*See* list of publications at end of Directory.]

FIRST STAGE OR ELEMENTARY COURSE.

SOUND.

Sound produced by vibration. Sound transmitted through solids, liquids, and gases.

Study more particularly air.

Air particles have only vibratory motions.

Longitudinal and transversal vibrations.

Sound wave consists of alternate compressions and rarefactions.

Simple harmonic vibration of a pendulum. Amplitude of vibration.

Vibration frequency. Wave length.

Velocity of sound. Methods of measuring velocity on a large scale in (1) air, (2) water.

Velocity greater in warm than in cold air.

High and low notes travel with the same velocity.

The loudness of a sound depends upon the amplitude of the vibration of the particles.

The pitch of a sound depends upon the frequency of the vibrations.

The fact that high and low notes travel with the same velocity proves that the wave length varies inversely as the frequency.

Reflection of sound. Angles of incidence and reflection equal. Echoes. Whispering galleries. Speaking trumpet.

Acoustic transparency of the air.

LIGHT.

Propagation in straight lines. Shadows. Penumbræ. Images formed by pinholes.

Intensity of light. Law of change of intensity with change of distance from a luminous point. Photometry.

Reflection of light. Plane mirrors. Parallel and inclined plane mirrors. Concave and convex spherical mirrors. Methods of determining the position of the principal focus of a concave mirror (1) by optical experiment, (2) from the radius of the mirror (supposed known). Formation of images. Real and virtual images. Conjugate foci treated experimentally. Geometrical construction for the image of a small object on the axis of the mirror when the position of the centre or principal focus is given.

Refraction of light. A ray of light passing from a less dense to a more dense medium is bent towards the perpendicular to the separating surface and conversely. General form of the path of a ray of light passing through (1) a plate, (2) a prism, (3) a lens.

Thin convex lenses. Methods of determining by experiment the position of the principal focus of a convex lens.

Formation of images. Real and virtual images.

Conjugate foci treated experimentally. Geometrical construction for the image of a small object on the axis of the lens when the position of the lens and of its principal foci are given.

Refractive index.

Application of the convex lens to prove that the ratio of the distances from a plane refracting surface of an object, and of its image formed by refraction at the surface, is constant and depends only on the nature of the two media on each side of the surface.

Definition of refractive index as ratio of these distances.

Hence geometrical constructions for the path of a ray of light through (1) a plate, (2) a prism.

Heat.

Distinction between heat and temperature.

Construction of mercurial thermometer.

Different thermometric scales.

Expansion of solids. Linear and cubical expansion.

Effects of unequal expansion.

Expansion of liquids. Cause of the difference between absolute and apparent expansion.

Peculiarity in the expansion of water.

Expansion of gases.

Specific heat. Calorimeters. Method of mixtures. Consequences of the high specific heat of water.

Fusion and solidification. Melting points. Meaning of the term latent heats. Change of volume during fusion. Effects of frost.

Boiling points. Meaning of the term latent heat of vaporization.

Convection of heat in liquids and gases.

Heating buildings by hot water. The Gulf Stream and ocean currents.

Conduction of heat. Effects due to the high or low conducting power of various substances.

Second Stage or Advanced Course.

The advanced course in each subdivision is as follows. But a candidate will be expected to have a knowledge of all the matters which are included in the first stage. Thus a candidate who takes up Sound in the advanced course will be expected to have a knowledge of light and heat equivalent to that required in the elementary course, and so on.

VIII*a*.—Sound.

Wave velocity.

Relation between wave length, vibration frequency, and velocity of wave propagation.

Boyle's law.

Meaning of the terms stress, strain, co-efficient of elasticity. Measures of these quantities in a gas.

Newton's relation between the velocity, elasticity, and density.

Effect of changes of temperature, and of pressure on the velocity of sound in a gas.

General explanation of Laplace's correction of Newton's formula.

Methods of measuring velocity of sound.

Reflection and refraction of waves. Explanation and application to the reflection and refraction of sound.

Musical tones. Methods of measuring pitch. Musical scales. Temperament.

Interference of waves. Beats. Relation between the frequency of beats, and the frequency of the notes which produce them. Comparison of tuning forks with a standard. Tartini's beats.

Modes of vibration. Stationary vibrations.

Nodes and nodal lines.

Transversal vibrations of strings.

Change of pitch due to changes in the length, diameter, material, and stretching force of a string vibrating transversely.

Harmonics.

Melde's apparatus.

Transversal vibrations of rods.

Tuning forks.

Longitudinal vibrations of strings, rods, and columns of air.

Change of pitch due to changes in the length, diameter, material, and stretching force of a string vibrating longitudinally.

Mouth (or flue) organ pipes open and stopped. Harmonics. Galton's whistle.

Vibrations of plates. Chladni's figures.

Bells.

Resonance. Forms of resonators. Analysis of compound notes. Sympathetic vibrations. *Timbre* or quality of notes. Consonant and dissonant intervals.

Theory of discords.

Composition of the vowel sounds.

VIII*b*.—Light.

Reflection. Goniometers. Hadley's sextant.

Proof of the algebraical relations between the focal length of a spherical mirror and the distances of an object and its image from it. Applications of the formula to simple cases.

Parabolic mirror.

Spherical aberration. Caustics.

Refraction. Definition of the sine of an angle.

Calculation of the sines of the angles of a right-angled triangle when two of the sides are given.

The laws of refraction.

The refractive index expressed as the ratio of the sines. Proof of the relations between the refractive index and the distances of an object and its image from (1) a plane, (2) a spherical refracting surface.

Spherical aberration. Focal lines.

Total internal reflection. Critical angle.

Deviation. Calculation of the deviation of a ray on passage through a prism.

Methods of measuring refractive indices.

Methods of determining the focal lengths of lenses.

The principle of the telescope and microscope, astronomical telescope and opera glass.

Dispersion. The composite character of white light. Calculation of the dispersion of a ray or passage through a thin prism.

Achromatism. Calculation of achromatic combinations of thin prisms and lenses. Construction of achromatic lenses.

The theory of light.

Methods of measuring the velocity of light (1) in interplanetary space, (2) in air, (3) in other media.

Explanation of the laws of reflection and refraction by (1) the emission theory, (2) the wave theory of light. Energy of radiation. The ether and its hypothetical properties. Crucial test between the two. Physical meaning of the refractive index. Relation between the properties of wave and light.

Interference of light. Colours of thin plates. Newton's rings. Fresnel's interference bands. Methods of measuring the wave length of light from interference phenomena.

Diffraction. The diffraction spectrum. Method of measuring the wave length of light.

Polarization. Passage of light through tourmaline and Iceland spar. Ordinary and extraordinary rays. Nicol's and other polarizing prisms. Polarization by reflection. Simple forms of polariscope and saccharometer.

Relations between light and ordinary matter. Spectrum analysis. Spectra produced by glowing solids, liquids, and gases. Physical explanation of these facts.

Displacement of lines in the spectrum by the relative motion of the observer and the luminous body. Applications of this fact and of spectrum analysis to astronomy.

Effects of the incidence of radiation on matter. Absorption accompanied by (*a*) the production of heat, (*b*) chemical action.

Extension of the spectrum beyond its visible limits. Selective absorption.

Relations between radiation and absorption by the same body. Absorption spectra.

Fluorescence, phosphoresence, phosphoroscope.

Colour vision. Colour blindness. Methods of testing. Trichromatic theory.

VIIIc.—Heat.

Sources of errors in the mercurial thermometer. Maximum and minimum thermometers.

The air thermometer at (1) constant volume, (2) constant pressure. Absolute zero of temperature deduced from the air thermometer.

Methods of measuring the expansion of solids, liquids, and gases.

Calorimetry. Accurate methods of measuring the specific heats of solids and liquids.

Specific heats of gases at constant pressure.

Atomic heat. Dulong and Petit's law. Anomalous specific heats. Specific heats of compounds.

Nature of heat. Definition of a method of measuring energy. Different kinds of energy. Transformation of energy of visible motion into heat.

The mechanical equivalent of heat.

The first law of thermodynamics.

Transference of heat. Physical nature of conduction. Physical nature of radiation.

The reflection of non-luminous radiation. Black bulb thermometers in air and vacuo.

The second law of thermodynamics.

The absolute scale of temperature.

Fusion and solidification. Changes in the melting points of bodies produced by pressure.

Black's and Bunsen's calorimeters.

Vaporization and liquefaction. Evaporation. Saturated and non-saturated vapours. General form of the isothermal curves of vapours and gases.

Condensation of aqueous vapour. The dew-point. Means of determining it. The hygrometric state of the air and its measurement. (The wet and dry bulb hygrometer. Condensation hygrometer.) Clouds. Rain. Snow and hail.

Expenditure of the latent heat of vaporization on internal and external work. Methods of liquefying and solidifying refractory gases, such as air, oxygen, &c.

Spheroidal state.

Gases. Joule's experiments on the internal work of expanding gases. Thomson's and Joule's experiments. Relation between the specific heats of gases at constant volume and constant pressure.

Adiabatic expansion or compression.

Determination of the ratio between the specific heats from the velocity of sound.

The principle of the method of calculating J from observations on gases.

Sublimation.

Applications of electricity in the construction of thermal instruments.

General principles of the galvanometer, thermopile, electrical pyrometer.

Honours.

Candidates can take honours in each of the above three subjects, viz., either in Sound, Light, or Heat.

In each case not only will an intimate knowledge be expected of the elementary course and of the advanced course corresponding to the subject in which the candidate offers himself, but questions may be set involving a knowledge of the relations between that subject and other branches of Physics. Questions may also be set which involve a knowledge of the calculus and of easy differential equations, though a choice will always be afforded so as to enable students who have not attained this knowledge of mathematics to gain a first class without it.

Candidates must also show themselves to be practically acquainted with the apparatus used in the study of the subjects in which they present themselves.

The examination will consist of a preliminary written paper, and those who qualify therein may be required to attend a practical examination at South Kensington at a subsequent date.

SUBJECT IX.—MAGNETISM AND ELECTRICITY.

Note.—An outline of elementary experiments, together with a description of the necessary apparatus, for illustrating this subject has been prepared; this (Price 6*d.*) and a syllabus of the course of practical instruction in Physics at the Royal College of Science, South Kensington (Price 1*s.*), may be obtained on application to the Department. [*See* list of publications at end of Directory.]

First Stage or Elementary Course.

Magnetism.

General properties of magnets.—Attraction of iron. Action of magnets upon one another. Distinction between poles. Position of equilibrium of suspended magnet. Magnetic axis of a magnet. Names of poles. Behaviour to one another of like named and unlike named poles. Lines of magnetic force; their general distribution in easy cases as shown by means of iron filings.

Magnetic Induction.—Effect of a magnet on a neighbouring piece of soft iron. Diminution of the effect with increase of distance. Comparison between such effects on hard steel and on soft iron.

Permanent magnetisation of hard steel.—Methods of magnetisation by means of permanent magnets. Distribution of magnetism in magnets. Effects of breaking or subdividing magnets. Differences between the properties of different magnets depending upon their size, shape, and degree of magnetisation. Astatic needles and other simple combinations of magnets.

Terrestrial magnetism.—Magnetic meridian; Declination; Inclination (Dip). Mariner's compass and dipping needle; their behaviour at different parts of the earth. General explanation of the behaviour of compass and dipping needle on the assumption that the earth is a magnet. Magnetisation of soft iron by the earth.

Frictional Electricity.

Electrification by friction. Two distinct electrical states and their mutual relations. Positive and negative electrification. Simultaneous and equal development of the two electrical states. Action of electrified bodies on each other. Conductors and non-conductors. Conducting bodies are at different potentials if electricity passes between them when they are put in conducting communication. Analogies with temperature and level. Effect of connecting a conductor with the earth. To maintain a difference of potential between an earth connected conductor and the earth work must be done. Experiments illustrating the relation between a primary electrical charge and the correlative induced charge. The Leyden jar and similar arrangements. Distribution of electricity on conductors. Action of points. Properties of hollow conductors. Frictional electrical machines. Electric discharge.

Voltaic Electricity.

Experiments proving the different electrical conditions of two copper wires connected, one with a piece of zinc, the other with a piece of platinum or copper, the platinum or copper and the zinc both dipping into the same vessel of dilute sulphuric acid. Results of connecting the copper wires with each other. Description of the most common forms of voltaic cell. Connexion of cells in series to form voltaic battery. Increased difference of electrical conditions of terminal wires of a battery as the number of cells is increased. Evidence that this difference is of the same kind as that between the prime conductor and the rubber of a machine. Production of currents of electricity through conductors joining the terminals of a battery.

Properties and Effects of Electric Currents.—Evolution of heat, influence upon magnetic needles, magnetisation of soft iron, chemical action (*a*) inside the battery (*b*) outside (electrolysis). Magnetic properties of coiled conductors through which a current is passing. Current in the battery. The astatic galvanometer, and its application to the detection of weak currents.

An alternative syllabus for Stage I. of Science Subjects VIII. and IX. will be found at p. 167.

Second Stage or Advanced Course.

Magnetism.

The subjects of the elementary course, together with the following:

Every magnet exhibits the two opposite magnetic properties in an equal degree. Magnetic moment of a magnet. Comparison of magnetic moments. Law according to which the force between two magnetic poles varies with the strength of the poles and their distance apart, with its results and applications in simple cases. Mutual action of two small magnets at a distance from each other, especially in the case where the axis of one magnet produced bisects that of the other at right angles. Terrestrial magnetism. Determination of magnetic declination and inclination. Comparative measure of the intensity of the earth's magnetic force at different places and times.

Frictional Electricity.

The subjects of the elementary course, together with the following:

The quantitative law of electrical attraction and repulsion, with its results and applications in simple cases. Quantity and density of electricity; electrical potential; electrical capacity. Relation between capacity of a Leyden jar, the size of its coatings, and thickness and quality of the glass. Specific inductive capacity. Energy of an electric charge.

Description of construction and principles involved in the use of such instruments as the frictional electrical machine, condenser, Leyden jar, electrophorus, induction machine, electrometer.

Voltaic Electricity.

The subjects of the elementary course, together with the following:

Methods for the comparative measurement of the strength of currents, electromotive forces, and resistances in metallic conductors and electrolytes. Principles on which these methods depend; construction and use of instruments required for their practical application. Relation between electromotive force, resistance and strength of current. Meaning of the terms ohm, volt, ampère, and mutual relations of the quantities expressed by them. Divided circuits. Conditions determining the amount of heat developed in a conductor traversed by a current. Thermo-Electricity. Thermal effects at junction of dissimilar metals when traversed by a current. Electrotype; Voltameters. Relation between the strength of an electric current and rate of chemical action produced by it.

Electro-magnetism and magneto-electricity.—Direction and magnitude of magnetic force in the neighbourhood of the current. Simpler laws of magneto-electrical induction. Magneto-electric machines for the conversion of mechanical work into current energy. Electro-magnetic machines, and the conversion of the energy of the current into mechanical work. Simple laws of attraction and repulsion of currents. Induction of currents.

Examination for Honours.

The subjects of the elementary and advanced course, together with absolute measurements of magnetic and electric magnitudes. The Examination will consist of a preliminary written paper, and those who qualify therein may be required to attend a practical examination at South Kensington at a subsequent date.

SUBJECT X.—INORGANIC CHEMISTRY, THEORETICAL.

Students are at liberty to use any recognised system of nomenclature or notation in the examinations.

First Stage or Elementary Course.

Illustrations and examples of chemical action. Indestructibility of matter. Simple and compound substances. Laws of chemical combination in definite and multiple proportions. Dalton's atomic theory. Principles of chemical nomenclature. Symbolic notation. Formulæ and equations. Calculation of the quantities by weight taking part in reactions. Division of elements into metals and non-metals. Graphic notation so far as is necessary to explain the constitution of the following compounds, Hydrochloric acid, Water, Sulphuretted hydrogen, Ammonia, and Carbon di-oxide (Carbonic anhydride).

French and English weights and measures. Calculation of the weight and volume of gases at the standard temperature and pressure.

Hydrogen.—Its preparation and properties.

Chlorine.—Its preparation and properties. Hydrochloric acid; its preparation and properties, also its analysis and synthesis.

Oxygen.—Its preparation and properties.

Ozone or allotropic Oxygen.—Its preparation, properties, and constitution.

Water.—Its formation, properties, and composition. Determination of composition by analysis and synthesis.

SULPHUR.—Its properties, occurrence in nature, and allotropic modifications. Sulphuretted hydrogen, mode of preparation, properties, and composition of. Oxides of sulphur, modes of preparation, properties, and composition of. Sulphurous acid and the sulphites. Sulphuric acid and the sulphates, properties, and composition of, tests. Properties common to acids in general.

NITROGEN.—Preparation and properties. Nitrous and nitric oxides, composition, properties, and mode of preparation. Nitric acid and the nitrates. Composition, properties, and tests. Ammonia, composition, preparation, and properties. The atmosphere, its constitution; effects of animal and vegetable life upon it. Its composition as regards oxygen and nitrogen, and how determined.

CARBON.—Occurrence in nature, allotropic forms of; properties of. The two compounds of carbon and oxygen. Carbonates, composition and properties of.

An outline of elementary instruction (with experiments) illustrating subject-matter of the above syllabus and serving as a guide to teachers, has been prepared and may be obtained on application to the Department. Price *2d.* [*See* list of publications at end of Directory.]

ALTERNATIVE FIRST STAGE OR ELEMENTARY COURSE.

The following is an alternative syllabus for Stage I. of Inorganic Chemistry, and is intended for those students who only require the elements of chemistry as a foundation for their studies in other subjects.

A paper will be set in each syllabus at the examination in May, and a candidate may take either, but not both. His success will be registered as a success in the elementary stage of Inorganic Chemistry, and no second payment will be made on account of the same class at a future examination in that subject.

SOLUTION.—Solvent properties of water. Disappearance of a solid in water by solution. Saturation. Effect of increase of temperature on saturation. Effect of lowering the temperature on saturation. Crystallization. Filtration. Rain, spring, river, and pond waters, &c. Solid matter in different waters; how estimated. Loch Katrine water. Thames water. Sea water. Hard and soft waters. Mineral waters. Similar solvent action of other liquids. Solution of one liquid in another. Liquids insoluble in one another. Solution of gases in water and other liquids. The effect of heat on the quantity of gas dissolved by a liquid.

Experiments.—Suspend a piece of white sugar, on a tray of perforated zinc or wire gauze, by a thread in a glass vessel containing water. Dissolve salt in water. Show on a balance that sugar or salt and water when separate and when dissolved weigh the same. Show that salt is obtained from the solution by evaporation. Saturate water with nitre, and show that the solubility is increased by increase of temperature. Demonstrate the formation of crystals. Illustrate the removal of substances in suspension, and the non-removal of substances in solution by adding water to a mixture of black oxide of manganese and sugar, and then filtering. Show by evaporation the solid matter dissolved in a sample of pump, or river, or spring water, and explain the method for its quantitative determination. Show the like solvent action with other liquids, as camphor or shellac in alcohol, and fat or caoutchouc in ether. Compare the result of admixture of spirit or oil of vitriol with water with that of oil or mercury with water. Heat ordinary water and collect the expelled air.

AIR.—Surrounds the globe. Wind is air in motion. Air occupies space. The bulk of any quantity of air is much changed by temperature and by pressure. Air has weight. The necessity of air for animals and plants. Bodies when burning require air. Air a mixture of two gases, viz., oxygen and nitrogen. The proportion of nitrogen to oxygen. Oxygen the active body in air. Bodies burn in oxygen, and more brilliantly than in air. The combination of oxygen with iron and with other bodies. Increase of weight of bodies which unite with oxygen. Nitrogen does not combine directly with bodies. The nearly constant composition of pure air. Presence of other gases in small amount in air. Water in the air as a gas. The drying up of water.

Experiments.—That air occupies space may be shown by plunging a bell jar into a vessel of water. Fit a flask containing water with an india-rubber plug and delivery tube, heat the water, and collect the expelled air in a test tube inverted in a tumbler of water. Close the short limb of a syphon tube containing air, and compress the air in the short limb by pouring in mercury. Weigh a flask full of air, and fitted with a cork, glass tube, caoutchouc tube, and clip; exhaust by sucking out the air, and weigh again. Show that a lighted candle is soon extinguished when burnt under a lamp-glass resting on the table, but that it continues to burn if fresh air be supplied by supporting the lamp-glass on two pieces of wood. Burn phosphorus in a tall bell jar over water, and show the diminution of bulk of air. Ignite phosphorus, place it in the remaining gas. Burn some phosphorus under a dry bell jar to show the compound of phosphorus and oxygen which is formed. Fix a pellet of phosphorus on the end of a piece of wire, and place in a test-tube graduated with a slip of paper and inverted in a tumbler of water to show that at ordinary temperatures it combines with the oxygen of the air and removes it, so that by measuring the volume of gas left the amount of oxygen contained in air can be roughly determined. Burn charcoal and sulphur in oxygen, and call attention to their disappearance. Demonstrate by lime water and by litmus paper respectively that a new body is in each case formed. Burn iron powder (*Ferrum reductum*) on a scale pan of a balance to show that an increase of weight occurs. A glass or metal vessel filled with ice or cold water can be used to show the condensation of moisture upon it. Place calcium chloride on the pan of a balance to show the gradual increase of weight which occurs by absorption of aqueous vapour from the air.

WATER.—Its three states. Expansion of water by heat. Equal volumes at different temperatures have not the same weight. Formation of currents in water by heating. Boiling point. Increase of volume on conversion of water into steam. Distillation. Pure water. Hydrogen and its properties. The burning of hydrogen in air, and the weight of the product (water) compared with the weight of the hydrogen; the difference due to oxygen of the air with which hydrogen has combined. Hence oxygen and hydrogen are the constituents of water. Combination of oxygen and hydrogen with explosion to form water. If by measure there be twice as much hydrogen as oxygen, or by weight eight times as much oxygen as hydrogen, then no gas remains—all becomes water. All water composed of these two bodies in this proportion. These two bodies can then be separated from water and can be made to unite, and form water. In all cases of chemical combination bodies are united in constant proportion.

Experiments.—Illustrate the characteristic properties of ice, water and steam. Show that equal volumes of hot and cold water do not counterbalance one another. Fill a flask to the bottom of the neck with cold water, and then heat to show expansion of the water. Show current by heating a large flask of water. To illustrate distillation distil water containing copper sulphate. Show Liebig's or other forms of condensers. Show the mode of determining the boiling point of a liquid. Show that the temperature remains constant and that on dissolving substances in water the boiling point is raised. To show the presence of hydrogen in

water, pass steam through a red-hot iron tube filled with coarse iron turnings or nails. Note the change in the iron both in appearance and weight. This increase of weight and the weight of gas which comes off equals weight of steam which has been decomposed. Hence two substances in water, one the combustible gas that comes through the tube, the other the body which remains with the iron. Collect the hydrogen over cold water in proof that it is not steam, also show that it burns. Explode a mixture of two volumes of hydrogen and one volume of oxygen. Plunge a burning taper into jar of hydrogen held mouth downwards, to show burning of the gas and extinction of the taper. Show by a balloon or soap bubbles, or inverted beaker glass suspended from a balance, that hydrogen is lighter than air. Condense the water formed by the burning of a jet of hydrogen.

Carbon.—Charcoal, graphite, or black lead and diamond. When wood, sugar, meat, or bread are heated carbon remains. Charcoal not changed in the air at ordinary temperatures. Combination of carbon with the oxygen of the air at a red heat. Carbon dioxide a compound of carbon and oxygen. Chemical combination of carbon and oxygen is attended by the evolution of a definite amount of heat expressed by amount of water it will heat. Combustion. The properties of carbon dioxide. Water dissolves carbon dioxide at ordinary temperatures. Action of carbon dioxide on lime-water; no animal can live in this gas. 100 parts of carbon dioxide are composed of 27·27 parts of carbon and 72·73 parts of oxygen. Carbon dioxide obtained from marble, limestone, oyster-shells, chalk, &c. Charcoal fire. Coal composed of carbon, hydrogen, and a little oxygen, &c.: its burning is the result of the carbon and the hydrogen combining with oxygen. Whenever oil, tallow, or coal gas is burnt carbon dioxide and oxide of hydrogen (water) are formed. Respiration produces similar changes. In expired air the same products arise as from the burning of the food, and there is the same evolution of heat. Carbon a constituent of all animal and vegetable bodies.

Experiments.—Specimens of charcoal. Make charcoal by heating wood in a test-tube provided with a cork and delivery tube. The blacklead of a pencil as a specimen of graphite. Show that acids and alkalies do not change charcoal, but that when heated it soon burns away, and only ash is left. Take a small piece of charcoal in a glass tube, pass air over it into lime water, and show no change takes place until the charcoal is made red hot; as the charcoal disappears the lime water becomes milky. Prepare carbonic acid gas by acting on marble with dilute acid. Show by means of the balance, or by soap bubbles, or by passing it from one vessel to another, that carbon dioxide is heavier than air, that it acts on lime water, that a burning candle is extinguished in it. Its solubility in water shown by agitating a tube of the gas over water. Collect all the gas given off from a small piece of marble weighing 1 or 2 grammes. Show by collecting in inverted beaker the products of combustion of a candle, of a lamp, and of a gas flame, and adding lime water, that carbon dioxide is given off. Show also by means of lime water that respired air contains this gas.

Sulphur.—Known also as brimstone. Where found. Its properties. Is also found chemically combined with many metals, so not recognisable by the eye. Sulphur heated in the air melts; more strongly heated it burns, then the sulphur disappears; the strong smell produced belongs to a new body formed by the burning; this new body is a compound of sulphur and oxygen. Gaseous properties of the new body, its effect on blue litmus paper, which oxygen and sulphur have not. Its composition is 50·00 parts of sulphur and 50·00 parts of oxygen, and it is called sulphur dioxide. Water dissolves nearly fifty times its volume of this gas, and then turns blue litmus strongly red and has an acid taste. The combination of the gas with water to form sulphurous acid. Another compound of sulphur and oxygen can be made, in which the same weight of sulphur is combined with more oxygen. One hundred parts contain 40 of sulphur and 60 of oxygen, and it is called sulphur trioxide. Sulphur trioxide has properties differing from the dioxide. If the dioxide and oxygen be mixed they do not combine, but if they are passed

together over hot platinised asbestos dense white fumes are formed, which are the trioxide. Combination of the trioxide with water to form sulphuric acid (oil of vitriol).

Experiments.—Show roll and flowers of sulphur and specimen of native sulphur, also iron pyrites and other native sulphides. Powder iron pyrites and heat the powder in a test-tube held horizontally over a lamp to show the sulphur obtained from the pyrites. Show the melting of sulphur by heating flowers of sulphur in small flask.

Heat sulphur on a piece of tin plate till it catches fire, show the colour of the flame and observe the smell of burning sulphur. Prepare sulphur dioxide by heating copper turnings in strong sulphuric acid, and show that it extinguishes flame, is very soluble in water, and that the water dissolving it becomes very acid, turning blue litmus red. Bubble air through a strong solution of sulphur dioxide, and then over platinised asbestos; demonstrate that when the platinised asbestos is hot dense white fumes are formed which consist of sulphur trioxide. Pour some sulphuric acid into 20 or 30 times its volume of water and prove its acid taste, its action on litmus, and its power of causing effervescence if dropped on sodium carbonate. Show that sulphuric acid is a colourless liquid, that bulk for bulk it is more than $1\frac{3}{4}$ times the weight of water. Show by a thermometer or by immersing a test tube with spirit in it that a large amount of heat is evolved when this acid is poured into water. Pour some sulphuric acid on sugar or shake it up with oil to show its action on organic bodies.

CHLORINE.—The gas obtained by the action of hydrochloric acid on the black oxide of manganese. So called on account of its colour. Its characteristic smell. Is $2\frac{1}{2}$ times as heavy as air and $35\frac{1}{2}$ times as heavy as hydrogen. Soluble in water. Many substances take fire in chlorine gas, *e.g.*, phosphorus, and form chlorides. Ignition of oil of turpentine in chlorine with separation of carbon and formation of hydrochloric acid. Bleaching power of chlorine. Bleaching-powder.

Experiments.—Samples of common salt, rock-salt. Prepare chlorine from (1) mixture of common salt, black oxide of manganese and sulphuric acid; (2) from mixture of black oxide of manganese and hydrochloric acid. Collect gas by downward displacement. Draw attention to its colour, and show that phosphorus spontaneously inflames in the gas to form chemical compound of phosphorus and chlorine. Show that oil of turpentine ignites spontaneously in chlorine. Show that sodium when strongly heated and immersed in a jar of chlorine burns and forms common salt. Show bleaching action of chlorine by dipping moistened Turkey red rag in bottle filled with gas. Show similar action with solution of bleaching-powder and acid. Show that chlorine is soluble in water and that the solution has characteristic smell and colour of the gas.

ACIDS.—Are bodies which have sour taste, turn blue litmus red, and liberate carbon dioxide when added to solution of sodium carbonate. Sulphuric acid has these properties. There are two other common bodies which have strong acid properties like sulphuric acid, these are nitric acid and hydrochloric or muriatic acid; these are made of different constituents from sulphuric acid. All act on litmus, &c. in same way; all can be neutralised by potash forming potassium sulphate, or nitrate, or chloride. The compound formed by the union of an acid and an alkali is called a salt. All three acids are colourless liquids, but, beside the properties possessed by all acids, each acid has properties which belong to it alone. Nitric acid attacks most metals. Poured on copper the metal is dissolved and red fumes are formed. Hydrochloric acid does not dissolve copper, is not so heavy as sulphuric acid; when mixed with manganese dioxide and warmed a yellow irrespirable gas known as chlorine is given off.

Experiments.—Samples of nitric and hydrochloric acids. Show tha both have all the properties belonging to acids, and that by neutralisin them with potash and soda respectively nitre and common salt can be made. Show the action of nitric acid on copper, tin foil, &c. Show that

it has no action on platinum or on gold. Copper placed in hydrochloric acid not attacked, but if mixed with manganese dioxide and warmed chlorine is given off.

ALKALIES.—Are another class of bodies which turn red litmus blue; have soapy taste and absorb carbon dioxide. If potash be added gradually to sulphuric acid the properties of both bodies gradually disappear, and at last a liquid is obtained that has no action on litmus. This combination of acid and alkali is sulphate of potash or potassium sulphate; sulphate of soda or sulphate of ammonia can be formed in a similar manner.

Experiments.—Show that solutions of potash, soda, and ammonia turn reddened litmus blue, and that when a tube containing carbon dioxide is inverted in any of these solutions the gas is absorbed. Add gradually to dilute sulphuric acid one of these bodies, and see that the acid character of the dilute sulphuric acid disappears. Neutralise exactly sulphuric acid with potash, then evaporate and crystallise out the salt formed.

AMMONIA.—A gas with a very pungent smell. Solution in water. One volume of water dissolves 800 volumes of ammonia. This liquid has the pungent smell of the gas, and it can neutralise the strongest acids. Formation of ammonium chloride or sal ammoniac by ammonia with hydrochloric acid. Ammonium chloride a white solid, soluble in water, with no smell of ammonia. Ammonium chloride a volatile body. The effect of boiling a solution of ammonium chloride with lime or potash. Ammonia is composed of 82·3 parts of nitrogen and 17·7 parts of hydrogen. The pungent odour of smelling salts is due to ammonia. Animal matters, such as horn, dried flesh, glue, cheese, isinglass, heated so as to decompose these bodies, yield ammonia. The formation of ammonia in large quantities by heating coal to make coal gas. Production of ammonia when animal matters containing nitrogen putrify.

Experiments.—Prepare ammonia by treating ammonium chloride with an equal weight of slaked lime and enough water to make the whole into a thick mud: and demonstrate its smell, its action on red litmus, and its great solubility in water. The gas passed into water, the increase of volume of the liquid. Its properties and their identity with those of the gas. Volatility of ammonia shown by the liquid leaving no residue on evaporation. Show that ammonium chloride is formed by neutralising a solution of ammonia with hydrochloric acid, and is obtained as a solid on evaporation, and that on further heating it is volatilised. Heat coal in a coarse powder in a test-tube provided with a cork and delivery tube, and show that the liquid obtained is very alkaline. Show the formation of ammonia by the addition of potash and lime to a solution of ammonium chloride.

LIME AND CLAY.—Limestone, marble, oyster-shells, and chalk, all contain a metal known as calcium. The oxide of this metal known as lime. Lime and carbon dioxide are together present in limestone, marble, shells, and chalk. When these are strongly heated, especially in a current of air, the carbon dioxide is evolved and the lime is left. Action of water on lime. Use of lime in making mortar. Lime slightly soluble in water. On blowing carbon dioxide into a clear solution of lime (lime-water), liquid becomes turbid, owing to combination of carbon dioxide and lime to form chalk. Same effect on breathing through lime-water. Other important salts of lime are gypsum or plaster of Paris (sulphate of lime) and phosphate of lime, which latter exists largely in bone. Clay is a combination of a body called silica, which is the chief constituent of sand and flint, with the oxide of a metal known as aluminium, so called because it exists also in alum. Glass is a compound of silica with lime and an alkali, potash or soda. Varieties of clay; their use in manufacture of bricks and pots. The metal contained in clay (aluminium), a white body with a brilliant lustre, 2½ times as heavy as water; may be rolled out into thin sheets and drawn into fine wire. Not oxidised in the air.

Experiments.—Samples of limestone, marble, oyster shells. Show that these substances effervesce with dilute hydrochloric acid, and that a gas carbon dioxide is evolved. Heat a piece of limestone or marble to redness in a fire, and show that after heating it no longer gives off carbon dioxide on treatment with an acid. Describe process of lime-burning. Properties of lime as distinguished from limestone. Show that a piece of moistened red litmus paper pressed against limestone is not affected, but that when pressed against lime it is turned blue. Show slacking of lime; draw attention to heat evolved. No such result on treating limestone with water. Show that lime is soluble in water, whereas limestone is not. Add carbon dioxide to the solution of lime, and show that white powder is formed which on treatment with acid evolves carbon dioxide again. Explain that white powder thus formed is identical in chemical composition with limestone, and hence that limestone is a compound of carbon dioxide and lime. Show plasticity of clay and exhibit one or two specimens of ware before being baked. Show that a vessel of kneaded or "puddled" clay will hold water. Explain chemical nature of clay, and show specimens of silica and alumina. Show alum and demonstrate that alumina is contained in it by heating ammonia alum. Show specimen of aluminium and explain that this metal is contained in alumina and therefore in clay.

METALS, INTRODUCTORY.—About 70 different elementary substances known. All the common metals are elements. For instance, iron, lead, copper, zinc, mercury, silver, gold, tin, are elements. All combine with oxygen to form oxides, with chlorine to form chlorides, and with sulphur to form sulphides.

Experiment.—Specimens of metallic and non-metallic elements and of oxides and sulphides.

LEAD.—Its colour; a fresh surface bright, but soon tarnishes in the air. Lead is 11½ times as heavy as water. Can be beaten or rolledinto thin sheet or drawn into wire. Melts at temperature 633° F. Can be cast in a mould. Its combination when liquid with oxygen. Formation of lead oxide. The oxide has entirely different properties from lead. Removal of the oxygen when heated with carbon and the formation of metallic lead. Formation of red lead by heating the oxide. Solution of lead by nitric acid and the formation of lead nitrate. Solution of lead oxide by nitric acid and the formation of lead nitrate. Similarly to potassium nitrate this is to be termed "a salt." Its solution in water. Other salts of lead, chloride, sulphate. Formation of sulphate and chloride of lead, their insolubility in cold water. Galena, or lead sulphide, one of the ores from which lead is obtained.

Experiments.—Piece of lead to scrape and show it is then bright and has "metallic" appearance. Show by balance that compared with water it is bulk for bulk much heavier. Show the metal beaten out into thin sheet, also as wire. Melt lead in an iron spoon, and cast in a mould. Show formation of oxide by blowing air on to the melted metal. Contrast the properties of the oxide with those of the metal. Convert the oxide again into metal by strongly heating an intimate mixture of it and charcoal powder. Heat the oxide to show its further oxidation and the formation of red lead. This oxidation is hastened by adding a little chlorate of potash. Show the action of nitric acid on lead, also on lead oxide, and the formation of lead nitrate. Show this is "a salt," and prove that it is soluble in water. Demonstrate that lead is very slightly soluble, and lead oxide almost insoluble in water. Show the formation of chloride and sulphate of lead by the addition of the respective acids to a solution of lead nitrate. Collect on filter the salts so formed, wash and dry them. Show specimen of Galena (lead sulphide).

IRON.—Not used in a pure condition, always obtained united with carbon. Three kinds of iron; wrought iron, cast iron, and steel. Wrought iron the purest and used if the body is to be formed by hammering. Cast iron contains most carbon. Steel used for cutting instruments; can be made into a magnet; can be "annealed." Solubility of all three forms of iron in

sulphuric, nitric, and in hydrochloric acids, and the formation of iron sulphate, nitrate, and chloride. Their solubility in water. Melting point of iron is at much higher temperature than that of lead. Comparison of the weight of iron with that of water. Its colour. The ready action of moist air *containing carbonic acid* on it. Formation of rust. Oxidation by heating. The action of steam on iron when red hot. Oxide of iron heated with hydrogen or with carbon parts with its oxygen, and iron is left. Oxide of iron found in the earth. Hæmatite. Clay iron stone, a carbonate of iron mixed with clay used as a source of iron. By heating the ore oxide of iron is obtained. Removal of the oxygen by heating it to a very high temperature with carbon. Formation of slag from clay and lime.

Experiments.—Specimens of the different kinds of iron, wrought iron, cast iron, and steel. Dissolve cast iron in hydrochloric acid diluted with equal volume of water, show carbon which remains, filter and evaporate the liquid to show the chloride of iron formed. Heat iron wire by the blowpipe to show the high temperature required to fuse it. Iron acted on by air and moisture to show its rusting. Heat iron oxide in a tube and pass hydrogen over it to show formation of water and metallic iron. Show specimens of iron ores, clay iron stone, hæmatite, magnetic iron ore, and slag.

Copper.—Its colour. Does not rust in air at ordinary temperatures. Thin wire melts in flame of Bunsen burner. When heated in air becomes black, owing to formation of an oxide. Oxide heated in hydrogen gas yields up its oxygen, water is formed, and the red-coloured copper is obtained. Action of acids on copper. With dilute nitric acid evolves a colourless gas, which turns red in contact with the air, and the metal dissolves, forming a blue solution of copper nitrate. Heated with sulphuric acid copper yields sulphur dioxide, the same gas which is formed when sulphur burns in air or in oxygen. The substance formed when copper dissolves in sulphuric acid is when crystallised from water of a fine blue colour, known as copper sulphate or blue vitriol. Action of vegetable acids on copper. Verdigris. Use of copper in alloys. A penny composed of 95 parts of copper, 4 parts of tin, and 1 part of zinc. Bell metal and gun metal contain copper and tin.

Experiments.—Show specimens of copper in bar, sheet, and wire. Point out characteristic colour of metal. Heat piece of sheet copper over flame of Bunsen burner. Show formation of black film. Explain its origin. Take black oxide of copper and heat in hydrogen gas. Show that metal is again formed and that water is produced. Show action of nitric and sulphuric acids upon copper. Exhibit specimen of copper sulphate (blue vitriol). Show that on placing a knife blade in a solution of copper sulphate metallic copper is deposited on the steel. Show sample of verdigris and explain how formed. Show various alloys of copper, bell-metal; brass, gunmetal, &c., a penny-piece.

Mercury.—A liquid metal, but if it be cooled to $-40°$ Fahrenheit it is solid. Its metallic appearance. Its weight; heaviest liquid known; 13·6 times as heavy as water. Use in the barometer and thermometer. Does not rust or tarnish in the air at ordinary temperatures, oxidises if heated to about 600° F. in the air, and forms red mercuric oxide. Is readily attacked and dissolved by nitric acid. It dissolves many metals,—*e.g.*, tin, lead, &c.; amalgams. Mercury in combination with sulphur, as cinnabar. Mercury can be obtained from any salt of mercury by heat, volatilization of mercury, and the condensation of the vapour.

Experiments.—Specimen of mercury. Show that to balance one volume of mercury $13\frac{2}{3}$ volumes of water are necessary. Boil a little mercury in a test-tube to show it vaporizes. Treat mercury with nitric acid and show its solution. Show that tin foil is dissolved by mercury, which latter becomes less fluid. Heat mercuric oxide in a test-tube provided with cork and delivery tube and collect both the oxygen and the mercury. Heat mercuric chloride in tube sealed at one end with dry sodium carbonate and show the metallic mercury condensed on the sides of the tube.

Sodium.—Common salt contains a metal combined with chlorine known as sodium. 100 parts of common salt contain 39·3 parts of Sodium and 60·7 parts of Chlorine. Carbonate of soda (washing soda) contains sodium. Sodium obtained on strongly heating carbonate of soda with charcoal. Sodium one of the lightest solids known. Swims on the surface of water and decomposes that liquid with evolution of hydrogen and formation of the alkali soda. Other properties of the metal sodium: its low fusibility and softness. Its tarnishing in air. Preservation of sodium from action of air by being kept in some liquid lighter than water and free from oxygen.

Experiments.—Samples of common salt and rock salt; also washing soda and bicarbonate of soda. Recall experiment showing that chlorine is constituent of common salt. Show that washing soda and sodium bicarbonate evolve carbon dioxide on treatment with an acid; these bodies are compounds of carbon dioxide and sodium. Exhibit specimen of sodium. Show that it can be cut with a knife, and that the two portions can be pressed together again so as to form one piece. Exhibit metallic lustre of sodium; show that it quickly tarnishes in the air. Show that sodium is lighter than water and decomposes that liquid with evolution of gas (hydrogen). Collect hydrogen from water by thrusting small piece of sodium beneath test-tube filled with water and standing in basin of water.

Carbon Compounds.—Large numbers of substances are met with in plants and animals which are not found in the earth. Most of these bodies contain carbon. The other elements united with the carbon are hydrogen, oxygen, nitrogen; some bodies are composed of all these elements; others of only two of them. Many of these bodies when heated leave a black residue of carbon; when this is more strongly heated it burns away. The great number of these carbon compounds, and the great difference in their properties. Some are acids, *e.g.*, vinegar (acetic acid), and tartaric acid. Some are salts, *e.g.*, fats, tallow, butter. Some are neutral bodies, *e.g.*, sugar, starch, spirit.

Experiment.—Show that on heating any ordinary vegetable or animal substance carbon is left behind.

Acetic Acid.—One form of dilute acetic acid is known as vinegar. Formation of acetic acid when beer or wine exposed to the air becomes sour. The spirit present combines with oxygen of the air and forms acetic acid. The presence of a kind of fungus called mycoderma aceti necessary to cause this oxidation. Large amount of vinegar is made from poor kinds of wine and beer. Action of vinegar on blue litmus, and on sodium carbonate. Vinegar is also made by heating wood in a retort; a great many bodies distil over, among them acetic acid. The pure acid has a very pungent smell, and has all the properties which are characteristic of the acids. Boils at 246° F. Dissolves in water. It is composed of carbon, hydrogen, and oxygen in the proportion of 40·0 parts of carbon, 6·7 parts of hydrogen, and 53·3 parts of oxygen. It is, like sulphuric acid, neutralised by alkalies. Iron put into it is slowly dissolved, hydrogen being given off. Oxide of lead dissolves in it, forming a salt, and if the clear solution be evaporated a white crystalline body called "sugar of lead" is formed, which is lead acetate. The vinegar smell belongs only to the acid not to the salts. Sodium acetate has no smell; add to it sulphuric acid and warm, when the smell shows the acid has been liberated and that it is volatile.

Experiments.—Show that vinegar has the properties of an acid, and that a salt is formed on neutralising it. Show a specimen of the commercial acetic acid, and point out its colourless appearance and strong smell and acid reaction. Show that iron is acted on and dissolved by acetic acid. Make sugar of lead by dissolving lead oxide in acetic acid, and crystallise out the salt. Point out disappearance of the pungent odour of the acid on neutralisation by potash or soda. Demonstrate the liberation of the acid as indicated by the odour on addition of sulphuric acid to sodium acetate, and show that it can be separated from the liquid by distillation.

TARTARIC ACID.—Occurs in many fruits, especially in grapes. Is obtained from "argol," an impure potassium salt of tartaric acid, deposited when grape juice ferments. Tartaric acid is a crystalline solid, and dissolves easily in water. Has no smell. Is composed of carbon, hydrogen, and oxygen, *i.e.*, the same elements as are in acetic acid but in different proportions, viz. :— 32·0 parts of carbon, 4·0 parts of hydrogen, and 64·0 parts of oxygen. Its action on sodium carbonate. Effervescing draughts; seidlitz powders. Tartrates.

Experiments.—Specimen of argol and of crystals of tartaric acid. Show solubility of the solid acid in waters and that the solution has acid properties and is without odour. Demonstrate the presence of carbon in the acid by ignition.

FAT AND OILS.—Are neutral bodies made up of an acid and a base, the base in all cases is glycerine, the acid varies in different oils and fats. They are all insoluble in water. Oils are liquid; fats are solid. Many of the oils are obtained from vegetables, either from the seed or fruit. Most of the fats are from animals. Melting of tallow (fat of the ox, sheep, &c.) put in boiling water. Its non-solution in water. Its lightness as compared with water. If fat be boiled with a solution of caustic potash, the liquid becomes slightly milky, and nearly the whole of the fat dissolves. Combination of the potash with the acid (stearic) of the tallow and formation of potassium stearate. Previously the stearic acid was combined with glycerine. To the solution of potassium stearate hydrochloric acid is added. The potash is again separated from the stearic acid, and the stearic acid, as it cannot dissolve in water, separates out. Stearic acid dissolves in alcohol and in ether and separates out in crystals on evaporation. Used in making candles, and is better than tallow because it melts at a higher temperature. Tallow distilled with steam of temperature 600° F. (high pressure steam) separates into stearic acid and glycerine, and when cold these bodies remain separate. All oils and fats are decomposed by potash in the same way as tallow.

Experiments.—Tie beef or mutton fat up in muslin bag, and melt in boiling water to separate the fat from membraneous matter. Show that fat is insoluble in water, that it floats on water, and melts at a temperature below boiling water. Show that oil has very similar properties to melted fat. Boil oil or fat with caustic potash. Prepare a solution of potassium stearate, and precipitate stearic acid from it by the addition of hydrochloric acid. Show the solubility of the acid in alcohol and ether, and the insolubility of the lime salt of stearic acid.

GLYCERINE.—A thick colourless liquid with a sweet taste. Dissolves readily in water. When quite pure becomes solid at a low temperature. If heated alone it is destroyed, but if heated with water in a retort it distils over with the steam. Heated with acids it combines with them, and bodies similar to fats are formed.

Experiment.—Specimen of glycerine. Demonstrate its solubility in water and its sweet taste.

SOAP.—By boiling fat with caustic soda sodium stearate is formed. On adding salt to the liquid the sodium stearate, which is soap, separates out and solidifies on the surface of the liquid. Soft soap is potassium stearate. Action of soap in washing. Action of soap on hard and on soft waters.

Experiment.—Shake distilled water up in bottle with soap. Show action of solutions of salts and acids on the solution. Add soap solution to distilled water, also to common water, and explain the difference of action. Show the presence of stearic acid in soap by adding hydrochloric acid to a solution of soap.

SUGAR.—Exists in many plants. Is obtained from the sugar cane; also from beet root. The juice of these plants yields the sugar. When pure it is white, crystalline, sweet, and very soluble in water. Sugar candy. If heated with very little water to 365° F., on cooling it is no longer crystalline and is "barley sugar." Does not combine with acids, but even a very little

acid boiled for a long time with a solution of sugar changes it to another kind of sugar. Composition of cane sugar. The several different kinds of sugar, *e.g.*, the solid part of honey is a sugar which differs from the sugar in the sugar cane; the same found in all sweet fruits and is called grape sugar. Grape sugar not so sweet nor so soluble as cane sugar.

Experiment.—Specimens of ordinary white and brown sugar; also sugar candy and barley sugar. Show its great solubility in water; also that its solution is neutral. Heat it and point out the peculiar odour it gives out, and that on further continuing the heat it leaves a residue of carbon. Wash honey with spirit, and show the residue is sugar, but that it is not so sweet as ordinary sugar and not so soluble.

STARCH.—A neutral substance, composed of carbon, hydrogen, and oxygen. Composition. Peculiar structure; not crystalline. Is found in all parts of a plant. Is obtained from wheat, rice, potatoes, arrowroot, &c. Starch in its ordinary condition insoluble in water. When starch powder is boiled with water, the membrane of starch cells bursts, and the starch is partially dissolved. Strong solutions form a jelly when cold. Used for stiffening linen. Starch recognised by its forming a blue compound with iodine. Undergoes no change in the air at ordinary temperatures; if heated to about 300° F. it becomes slightly discoloured and is changed into a soluble body, known as British gum (dextrin). If small amount of nitric or hydrochloric acid be added to the starch this change is more rapid. Extract of malt also changes starch into soluble compounds. Starch as a food.

Experiment.—Specimen (of starch), point out its peculiar structure and absence of crystalline form. Demonstrate that it does not dissolve in cold water, but on boiling some does dissolve. Show that starch both solid and in solution gives a blue colour when iodine is added to it. Moisten starch with very dilute hydrochloric acid, and heat to convert it into a gum, which is thus soluble in water.

GLUTEN.—If flour is tied up in a muslin bag and well kneaded in a basin of water, the water becomes milky, and on standing starch sinks to the bottom. All the starch in the flour can thus be removed, and then a sticky substance remains in the bag called gluten. About 70 per cent. of flour is starch and 10 per cent. is gluten. Gluten contains nitrogen, starch does not. These bodies represent two most important constituents of food. The gluten exposed to the air soon decomposes and smells very disagreeable (putrifies).

Experiment.—Tie some flour up in a piece of muslin and knead it for some time in a basin of water; the starch comes through and will settle to the bottom of the vessel and can be collected and examined; the gluten remains in the bag.

SPIRIT.—Alcohol, spirits of wine. A colourless, light liquid. Neutral to test papers. Has pleasant odour, boils at 173° F. Burns with a flame, which gives very little light, without leaving any black residue of carbon. A large number of different bodies dissolve in it. It is the intoxicating principle in wines and spirits. In beer there is 3 to 5 per cent. of alcohol. In light wines about 8 per cent. In spirits 60 to 75 per cent. The different flavours of wines and spirits depend on very small quantities of other bodies present. Alcohol dissolves in water, giving out heat.

"Proof spirit" contains 50·76 parts of water, and 49·24 parts of alcohol. If more water be present the spirit will not set fire to gunpowder when burning. Alcohol obtained from grape sugar. Fermentation grape sugar converted into alcohol and carbon dioxide by presence of some ferment such as yeast. Cane sugar on the addition of yeast is first converted into grape sugar, then into alcohol and carbon dioxide. Use of yeast in brewing. Yeast not necessary for making wine as there is already a ferment in expressed juice of grape.

Experiment.—Show it is neutral liquid dissolving in water, that it burns with nearly colourless flame, and leaves no residue of carbon. Show that it can be made to boil at much lower temperature than water by

placing test-tube of it in hot water. Distil beer and collect the alcohol and water which comes over; add quicklime to this. Allow it to stand some hours and distil again. Show that this is much stronger, catches fire readily, and tastes more burning. Make a solution of common sugar in a large flask; add yeast, and fit a cork with a bent tube to the flask. Let the tube dip into lime water. Place it in a warm place, and after some days show that spirit has been formed in the flask by distilling the liquid and collecting the portion coming over first.

All the substances and experiments mentioned above are to be shown to the class. This does not preclude such other experiments and illustrations as may suggest themselves to the teacher.

Second Stage or Advanced Course.

In addition to the subjects of the first syllabus of the elementary course (p. 186) students presenting themselves for the advanced examination will be assumed to have received instruction in the following:—

The experimental methods by which the composition of the following bodies have been accurately determined: — water, atmospheric air, hydrochloric acid, ammonia, the gaseous oxides of nitrogen, the oxides of carbon, sulphuretted hydrogen.

Laws of gaseous combination of elements and compounds, reduction of gaseous volumes to standard pressure and temperature. Calculation of quantities by volume and by weight.

Atoms and molecules, atomic and molecular weights. Atomic and molecular formulæ and equations. Specific heat and atomic heat of the elements. Graphic or constitutional formulæ. Atomic value or valency of the elements. Compound radicals. Classification of the metals.

Water.—Causes of permanent and temporary hardness in. Modes of softening. Suitability for domestic purposes. Determination of composition of water by weight and by volume.

Hydrogen Dioxide.—Its preparation and properties.

Atmospheric Air.—Mode of ascertaining exact composition of. Carbon di-oxide, amount contained in, and determination of. Aqueous vapour, determination of.

Chlorine.—Theory of bleaching. Composition and preparation of bleaching powder. Oxides and the following oxy-acids of chlorine, viz.:— Hypochlorous, chloric and per-chloric acids, preparation, properties, and composition of.

Acids.—Manufacture on the large scale of the following:—Sulphuric hydrochloric, nitric.

Bromine, and hydrobromic and bromic acids.

Iodine, and hydriodic, iodic, and periodic acids.

Fluorine.—Hydrofluoric acid.

Phosphorus, its sources and its allotropic modifications; its hydrides, chlorides, and oxides. Phosphoric acids and the phosphates. Hypophosphorous and phosphorous acids.

Arsenic, and its hydrides, chlorides, and oxides. Arsenious, and arsenic acids. Arsenites and arsenates. Detection of arsenic.

Boron, its occurrence and allotropic modifications. Boron tri-oxide. Boric acid.

Silicon, and silica. Silicic acid. Silicon hydride, silicon fluoride. Names and formulæ of some of the more important silicates (mineral).

THE MONAD METALS, especially potassium, sodium, ammonium, silver, and their more important compounds. Manufacture of soda-ash, soda-crystals, and caustic soda.

THE DYAD METALS.—Mercury, copper, zinc, cadmium, magnesium, barium, strontium, calcium, and their most important compounds.

The chief properties of the following metals, and the composition, preparation, and properties of their more important compounds:—Antimony, bismuth, tin, gold, aluminium, platinum, lead, chromium, manganese, iron, cobalt, and nickel.

HONOURS.

In addition to the above subjects, candidates for honours are expected to possess a knowledge of the following subjects:—

The properties of all the elementary bodies and their more important combinations (with the exception of the organic compounds).

Classification of the elements. Relations between quantivalence and atomic weight. Isomorphism. Specific and atomic volumes. Atomic heat. Constitution of salts. Theory of normal acid and basic salts.

The thermal phenomena of chemical combination. Thermal unit. Heat of combustion. Absolute thermal effect, and its equivalent in mechanical effect. Theory of flame. Cause of luminosity. Principles of spectrum analysis as applied to the determination of the composition of terrestrial matter. Dissociation. Diffusion of gases. Law of electrolysis.

The candidates will also be expected to show a satisfactory acquaintance with the latest discoveries in inorganic chemistry.

NOTE.—No candidate who does not pass the practical as well as the theoretical examination can obtain a medal or certificate in Honours. See Science sec. 31, p. 36.

SUBJECT X. *p.*—INORGANIC CHEMISTRY, PRACTICAL.

FIRST STAGE OR ELEMENTARY COURSE.

The practical knowledge of the candidate will in this stage be tested both by a written and a practical examination.

I. The subjects of the written examination will include—

(*a.*) The preparation of the elements and compounds enumerated in the elementary course of Subject X., (Theoretical,) and the methods of experimentally demonstrating their properties.

(*b.*) The principal re-actions, both wet and dry, of the following: lead, *mercury*, *aluminium*, calcium, magnesium, potassium, ammonium, carbonic acid, nitric acid, sulphuric acid, hydrochloric acid.

These questions will, as much as possible, be so framed as to prevent answers being given by students who have obtained their information merely from books and oral instruction. Any student on whom it is intended to claim payments in this stage may be called on by the inspector of the Department, when visiting the Laboratory, to repeat some of the experiments which he has had the opportunity of witnessing.

The value of the answers will be greatly enhanced by the neatness and clearness of the sketches; provided always, that an accurate knowledge of the construction of the apparatus is exhibited.

II. The practical examination will consist in testing two powders, neither of which will contain more than two metals and one acid from the above list. These powders will be soluble in water or dilute acid.

The value of the analytical results will be enhanced if the conclusions from the experiments be clearly stated and confirmed by more than one reaction.

No notes, books or analytical tables may be consulted during the examination.

Two and a quarter hours will be allowed for the examination in practical analysis and one hour for the written examination.

Second Stage or Advanced Course.

The examination will consist of two parts :—

I. A short written examination of about four questions, with the object of testing the candidate's knowledge of the ordinary methods of qualitative analysis and of the preparation of such bodies as are enumerated in Second Stage, Subject X.

II. A practical examination, in which the candidate will be given two substances for qualitative analysis, each containing not more than two simple salts.* No books or analytical tables may be consulted during the examination. The student should have studied the re-actions of the following metals : silver, lead, mercury, copper, bismuth, cadmium, tin, arsenic, antimony, iron, manganese, aluminium, chromium, zinc, cobalt, nickel, calcium, strontium, barium, magnesium, potassium, sodium, ammonium, and the following acids, hydrochloric, hydrobromic, hydriodic, hydrofluoric, sulphurous, sulphuric, carbonic, phosphoric, nitric, chloric, and hydrosulphuric.

The remarks with respect to inspection made in the Elementary Stage apply also to this grade.

Three and a quarter hours will be allowed for the examination in practical analysis and one hour for the written examination.

Honours.

The student will be required to have studied the more important methods of quantitative analysis. The examination will consist of two parts :—

I. An examination in qualitative analysis, in which two substances will be given which must be examined for the whole of the radicals contained in the list given in the Advanced Stage (Practical).

II. A practical examination in quantitative analysis, in which the candidate will be expected to show proficiency in the quantitative estimation of the ordinary metals and inorganic acids by gravimetric and volumetric analysis.

The gravimetric analysis should include exercises in the determination of the following metals : silver, lead, mercury, copper, tin, iron, manganese, aluminium, chromium, zinc, cobalt, nickel, calcium, barium, magnesium, potassium, sodium, ammonium ; and of the following acids, hydrochloric, hydrobromic, hydriodic, sulphuric, carbonic, phosphoric, nitric, and hydrosulphuric.

The volumetric analysis should include exercises in the ordinary methods of acidimetry and alkalimetry ; and use of standard solutions of potassium, permanganate, and iodine.

Eight hours will be allowed for the complete examination.

See note at the end of the syllabus for Honours in Subject X., Theoretical.

Where payments are to be claimed on the results of the instruction in Practical Chemistry the school must be provided with a laboratory complying with the following requirements, and a certificate that it does so comply must be given by the committee on page 4 of Form No. 120 (*see* Science *sec.* 18, p. 31).

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* The acids are considered as hydrogen salts.

No payments will be made in these subjects unless the laboratory has been passed by the inspector as satisfying completely the conditions laid down below.

These conditions must be considered as the minimum if payments are to be claimed. It is not intended as a complete list of the apparatus or reagents required by students in Honours nor even in the Advanced stage.

Grants in aid of the Supply of Fittings for Laboratories and Lecture Rooms for Science Classes in Ireland.

The following are the Conditions on which My Lords are prepared to make Grants :—

The rooms must be fit for the purposes for which they are to be used; they must be of sufficient height, properly lighted and ventilated. Ventilation by windows only is usually not sufficient. They should be means for admitting a supply of fresh air. The extraction of vitiated air is best accomplished by flues reaching to the top of the building.

The rooms must be devoted entirely to Science instruction, and the tenure must be such that the Committee are not liable to be ejected. Satisfactory evidence must be afforded that the class is of a permanent character.

In Laboratories each student should have a working space of at least 3 feet 6 inches by 2 feet 3 inches on the bench-table. Shelves for re-agents, &c. should be fitted above, and drawers and cupboards for apparatus, &c. below the table. Gas should be laid on to each student's bench, and there should be a water tap with an earthenware or lead-lined sink to every two students, if possible. Closets should be provided for evaporation of substances evolving noxious fumes and for sulphuretted hydrogen work. These closets should be ventilated by flues carried up in the wall of the building so as to ensure the extraction of the fumes. Niches with flues should also be provided for combustion furnaces. Further particulars as to fittings will be found in Form No. 1013.

The Laboratory must be a room, or part of a room, of a sufficient height to meet sanitary requirements; it must be set apart entirely for the study of Practical Chemistry or Practical Metallurgy; it may not be used as a class room for any other subjects; but it may, when not required for Practical Chemistry or Practical Metallurgy, be used as a laboratory for practical work in other experimental sciences.

The application for the Grant must be made on a printed Form (Science Form No. 789) to be obtained from the Department, *before the fittings are ordered*; it must be accompanied by full information on a printed Form No. 789a, which can be obtained from the Department, and must be returned signed by the Chairman and Secretary of the Committee.

When the work has been completed and favourably reported on by an Inspector of the Department, payment of the Grant will be made on receipt of a certificate from the Committee on Science Form No. 790, accompanied by the receipted vouchers.

Laboratory for Practical Inorganic Chemistry.

The laboratory must be a room or part of a room of a sufficient height to meet sanitary requirements It must be set apart entirely for the study of Practical Chemistry; it may not be used as a class-room for any other subjects; but it may, when not required for Practical Chemistry, be used as a laboratory for practical work in other experimental sciences. The laboratory and apparatus must, under any circumstances, be kept clean, tidy, and in good order—failing which payments may be reduced or withheld. It must be fitted with one or more properly arranged fume closets, there being one fume closet for every ten benches, and with proper working benches, one of which must be allotted to each student attending the class.* Each bench must be

* Drawings and descriptions of fittings for a Chemical Laboratory (Form No. 1013) may be obtained on application to the Department, price 1*s.* 6*d.* [*See* list of publications at end of Directory.]

at least 3 ft. 6 ins. wide, and 2 ft. 3 ins. deep; it must be provided with a cupboard and drawers for keeping apparatus, and with a rack or set of shelves for the necessary reagents. Between every two benches there must be a basin and sink with tap and water supply, and gas must be laid on to each bench with nozzles for fixing flexible tubes.

Each bench must be furnished with the following apparatus, which must always be kept in good working order, and when not in use, kept in the drawers and cupboards of the bench.

A Bunsen gas burner, with blow-pipe jet and rose burner.
A test tube stand.
Two dozen test tubes.
Test tube brush.
Mouth blow-pipe.
Piece of iron wire gauze.
Six inches of platinum wire.
Piece of platinum foil.
Set of three small beakers.
A wash bottle.
A box of blue litmus paper.
Retort stand with two rings, or its equivalent.
A tripod stand.
Sand bath.
Crucible tongs.
Spatula.
Two flasks.
One porcelain crucible.
Two porcelain evaporating basins.
Two funnels.
Filter papers.
Triangular and rat-tail files.

Each bench must be supplied with the following chemical reagents kept in proper stoppered bottles on the shelves of the working bench.

Sodium Hydrate.
Sodium Phosphate.
Sodium Carbonate.
Potassium Ferrocyanide.
Ammonium Oxalate.
Ammonium Chloride.
Ammonium Carbonate.
Ammonium Sulphide.
Ammonium Hydrate.
Barium Chloride.
Calcium Sulphate.
Silver Nitrate.
Lead Acetate.
Sulphuric Acid (concentrated).
Sulphuric Acid (dilute).
Nitric Acid (dilute).
Hydrochloric Acid (dilute).
Sulphuretted Hydrogen Solution.
Lime Water.
Borax.
Fusion Mixture.
Ferrous sulphate (crystals).
Manganese Dioxide.
Potassium nitrate.
Lime (powder).

Apparatus and Reagents for General Use.

A stock of the following apparatus must be kept for the supply of the students.

Test tubes, various sizes.
Boiling tubes.
Soft glass tubing.
Combustion tubing.
Glass rod.
Thistle funnels.
Corks assorted.
Caoutchouc tubing.
Large Berlin porcelain evaporating basin.
Stoppered German glass retorts, various sizes.
Large glass beakers.
Flasks, various sizes.
Gas jars.

The Laboratory must also be provided with sufficient of the following apparatus for general use.

Wedgwood-ware pestles and mortars.
Iron pestle and mortar.
Cork borers.

Gas or charcoal furnace.
A Liebig's condenser.
Sulphuretted Hydrogen apparatus.

One or more sets of the following reagents will also be required for general use.

Sodium Hypochlorite.
Potassium Ferricyanide.
Potassium Chromate.
Potassium Iodide.
Potassium Sulpho-cyanide.
Ammonium Acetate.
Ammonium Molybdate.
Ammonium Sulphate.
Mercuric Chloride.
Platinic Chloride.
Magnesium Sulphate.
Stannous Chloride.
Calcium Chloride.
Cobalt Nitrate.
Ferric Chloride.
Acetic Acid.
Tartaric Acid.
Nitric Acid (concentrated).
Hydrochloric Acid (concentrated).
Sulphurous Acid Solution.
Barium Hydrate.
Alcohol.
Ether.
Hydric Potassic Sulphate.
Potassium Cyanide.
Potassium Chlorate.
Starch.
Microcosmic Salt.
Methylated Spirit.
Charcoal.
Copper Oxide.
Soda Lime.

Where there are students who intend to take Honours in the examination in Practical Chemistry, the following set of apparatus AT LEAST must be provided for every SIX such students.

Two drying ovens.
A water bath.
An agate mortar.
A balance turning with $\frac{1}{100}$ of a grain.
A platinum or silver evaporating dish.
A platinum crucible.

SUBJECT XI.—ORGANIC CHEMISTRY, THEORETICAL.

THE CHEMISTRY OF CARBON COMPOUNDS.

First Stage.

Peculiarities of the element Carbon which render necessary the separate study of its compounds. Qualitative recognition of carbon, hydrogen, oxygen, nitrogen, the halogens, sulphur and phosphorus in carbon compounds. Methods for their quantitative estimation. Calculation of per-centage composition from the results of analysis and deduction of empirical formulæ. Determination of molecular weights.

Hydrocarbons *or Compounds of Carbon and Hydrogen.*

(1.) Paraffins or $C_n H_{2n+2}$ Series. Marsh gas or methane, ethane, propane, butane, pentane.

Modes of occurrence, preparation and general characters of paraffins. Homology and isomerism.

(2.) Olefine, or $C_n H_{2n}$ Series. Ethylene, propylene, butylene, pentylene.

Modes of occurrence, preparation and general characters of the olefines. Distinction between saturated and unsaturated hydrocarbons.

(3.) Acetylene or Ethine Series $C_n H_{2n-2}$.

Preparation and distinctive characters of acetylene.

Derivatives of the Hydrocarbons.

(1.) *Paraffins.—Haloid derivatives;* methyl chloride, methene chloride, chloroform, carbon tetrachloride, iodoform, ethyl chloride, bromide and iodide, ethene dichloride and dibromide.

Alcohols.—Methyl, ethyl, propyl, butyl, and amyl alcohols; primary, secondary and tertiary alcohols.

Methyl alcohol.—Destructive distillation of wood. Purification and properties of methyl alcohol.

Ethyl alcohol.—Modes of occurrence. Industrial preparation of spirituous liquids. Rectified, proof, and methylated spirits. Alcoholometry.

Preparation of pure alcohol, compounds and chief reactions of alcohol, constitution of alcohol. Fusel oils. Properties of propyl, butyl, and amyl alcohols.

Ethereal Salts.—Ethyl acetate, acid sulphate and sulphide, and mercaptan.

Ethers.—Manufacture of ethyl oxide.

Aldehyds.—General methods of preparation. Properties of formaldehyde, acetaldehyde.

Acids.—Series of fatty acids. General methods of preparation. Formic acid, occurrence, preparation, and properties. Acetic acid, manufacture. Vinegar, chief acetates.

Discussion of the constitutions of acetic acid, propionic acid, normal and isobutyric acids, palmitic and stearic acids. Nature of common fats, process of saponification. Hard and soft soaps.

Acetic anhydride and acetyl chloride, and their use as reagents for the recognition of hydroxyl.

Ketones.—Preparation and properties of acetone.

Compounds of alcohol radicles, with nitrogen, phosphorus, arsenic, silicon, and the metals, especially zinc and mercury. Cacodyl and its chief derivatives. Preparation and properties of zinc ethyl.

Amines.—Preparation and properties of primary, secondary, and tertiary ethyl monamines. Preparation and properties of phosphonium iodide.

Amides.—Distinguished from amines. Preparation and properties of acetamide.

Amido Acids.—Glycine (glycocoll).

(2.) *Olefines.*—Haloid compounds and derivatives of olefines, especially ethylene dichloride, and dibromide.

Alcohols.—Preparation and properties of glycol, acids from glycol, glycolic and oxalic acids, succinic, malic and tartaric acids and citric acid. Their modes of occurrence, preparation and properties.

Synthesis of succinic, malic, and tartaric acids.

Lactic Acids.

Allyl alcohol.—Acrolein, acrylic acid. Oils of mustard and garlic. Preparation and characteristic reactions of allyl alcohol.

Glycerin, and its chlorhydrins and nitrate (nitro-glycerin).

Mannitol and the *Carbohydrates.*—Cane sugar, dextrose (glucose) and levulose (fructose), maltose, milk sugar. Their occurrence in nature, manufacture, properties and distinctive tests.

Starch and the dextrins. Cellulose and gun-cotton.

Cyanogen Compounds.—Synthetical formation of cyanides.

Manufacture and properties of potassium ferrocyanide and ferricyanide Prussian blue.

Manufacture of hydrocyanic acid, the cyanides of potassium silver and mercury.

Preparation and properties of cyanogen.

Cyanic and cyanuric acids. Urea.

Constitution of urea. Source and characters of uric acid.

Second Stage.

Division of the carbon compounds into—

(1.) The *Fatty Division.*
(2.) The *Aromatic Division.*

Constitutiona differences between the two classes of compounds.

Examples of the production of closed chain compounds from compounds of the fatty division.

Benzene.—Sources, preparation and properties. Constitution of benzene. Preparation and properties of its more important homologues, especially toluene, the three xylenes, and cymene.

Mono-derivatives of benzene, viz. :—chloro-, bromo-, and nitro- benzene and benzene-sulphonic acid, also dinitrobenzene. Preparation and chief properties. Isomeric monochlorotoluenes.

Phenol.—Sources, manufacture and properties; nitro-phenols including picric acid.

Aniline.—Sources, manufacture and properties. Preparation of aniline sulphate, and hydrochloride. Action of nitrous acid upon aniline in aqueous and in alcoholic solutions. Constitution of diazo-compounds.

Nitranilines.—Preparation and characters.

Toluidine, source, manufacture and chief properties. Preparation of magenta dye. Constitution of rosaniline and its methyl and phenyl derivatives.

Phenyl hydrazine.—Preparation, properties, and uses as a reagent.

Quinone.—Preparation and properties.

Hydroquinone (Quinol).—Preparation and properties.

Benzyl alcohol.—Production from toluene.

Benzaldehyd.—Production from bitter almonds.

Amygdaline, an example of a glucoside.

Manufacture of benzaldehyde from toluene.

Benzoic acid.—Sources, manufacture, and properties.

Hydroxybenzoic acids, especially salicylic acid.—Sources, manufacture, properties, and uses of salicylic acid.

Toluic and *Phthalic acids.*—Sources and relations of.

Naphthalene.—Sources, purification, and properties, and derivatives of naphthalene.

Preparation and properties of the monochloro-naphthalenes, naphthalene-sulphonic acids, and naphthols, naphthol yellow. Constitution of naphthalene.

Anthracene.—Sources, purification and properties. Anthraquinone, preparation and methods for its conversion into hydroxyanthraquinones.

Alizarine, natural source and artificial production.

Constitution of Anthracene.

Pyridine.—Sources, purification, and properties. Constitution of pyridine.

Quinolines.—Source and properties of the quinolines (quinoline and leukoline).

Alkaloids.—Their general characters. Sources, preparation, and properties of morphine, strychnine, quinine, cinchonine, coniine, piperine, and piperidine.

Uric Acid Group.—Theobromine and caffeine.

Methods of distinguishing primary, secondary and tertiary bases.

Stereo-isomerism.

Van t'Hoff's hypothesis and its application to a few prominent cases, *e.g.*, the lactic and tartaric acids, amyl alcohols, valeric acids, glucoses.

Honours.

For honours, candidates will be required to show a thorough knowledge of the sources, preparation, and properties, and chemical relations of all the more important carbon compounds, including recent discoveries.

Special attention should be paid to methods of organic analysis and methods for the determination of molecular weight, the action of the more important reagents and the precise methods of using them in the investigation of the

constitution of carbon compounds; modern views of constitution, including the hypotheses of geometrical isomerism; orientation in the aromatic series and methods of determining the constitution of derivatives of benzene, naphthalene, &c. Synthetical formation of closed chain compounds, physical properties of carbon compounds.

Note.—No candidate, who does not pass the practical as well as the theoretical examination can obtain a medal or certificate in honours. *See* Science Sec. 31, p. 36.

SUBJECT XI. *p.*—ORGANIC CHEMISTRY, PRACTICAL.

First Stage.

In the first course the practical knowledge of the candidate will be tested both by a written and practical examination:—

I.—In the written examination the candidate will be expected to be practically acquainted with, and will be questioned upon the preparation of compounds enumerated in the First Stage of Subject XI., and the methods of experimentally demonstrating their properties. These questions will, as much as possible, be so framed as to prevent answers being given by students who have obtained their information merely from books and oral instruction. Any student on whom it is intended to claim payments in this stage may be called on by the Inspector of the Department, when visiting the Laboratory, to repeat some of the experiments which he has had the opportunity of witnessing.

II.—For the practical examination the student will be required to make himself practically acquainted with the re-actions of, and tests for, the following substances, and will be required to recognise in two or more powders soluble in water or dilute acid the following bodies: methyl and ethyl alcohols, glycerin, formic acid, acetic acid, oxalic acid, tartaric acid, citric acid, salicylic acid; not more than two of them being present in any one solution. The results to be carefully written out, and the presence of all bodies to be confirmed by two or more reactions.

No notes, books or analytical tables may be consulted during the examination.

Two and a quarter hours will be allowed for the examination in practical analysis and one hour for the written examination.

Second Stage.

The examination will consist of two parts:—

I.—A short written examination with the object of testing the candidate's knowledge both of the principles of the analytical processes and the methods of preparing and demonstrating the properties of such bodies as are enumerated in Second Stage, Subject XI.

II.—For the practical examination, the student will be required to make himself practically acquainted with the methods of detecting carbon, hydrogen, nitrogen, sulphur, chlorine, bromine and iodine in carbon compounds, the determination of melting and boiling points. He will also be required to examine qualitatively two mixtures each containing not more than two organic bodies.

The substances for analysis may contain the following constituents:—Hydrocyanic acid, formic acid, benzoic acid, oxalic acid, acetic acid, tartaric acid, citric acid, salicylic acid, cane sugar, glucose, starch, methyl and ethyl alcohols, glycerin, aniline-phenol, morphine, and urea.

He may also be required to prepare specimens of familiar compounds from materials supplied.

No notes, books or analytical tables may be consulted during the examination.

The remarks with respect to inspection made in the elementary stage apply also to this grade.

Three and a quarter hours will be allowed for the examination in practical analysis and one hour for the written examination.

Honours.

The examination will consist of two parts:—

I.—An examination in qualitative analysis as in the second stage (practical).

IIA.—The quantitative determination in one or more specimens (liquid or solid) given for analysis of the per-centage of carbon and hydrogen, or of one of the following: nitrogen, chlorine, bromine, sulphur; or determination of the molecular weight of an organic compound.

IIB.—Preparation of specimens: separation of organic compounds by distillation; fractional solution or crystallization: isolation of products of decomposition.

Eight hours will be allowed for the complete examination.

See note at the end of the syllabus for Honours in Subject XI.

Laboratory for Practical Organic Chemistry.

A Laboratory fitted up and equipped in accordance with the conditions specified in the case of Practical Inorganic Chemistry (*see* end of syllabus of *Xp.*, page 200) may be also used for instruction in Practical Organic Chemistry provided that in addition to the apparatus and reagents prescribed for that subject the following are kept for general use in the Laboratory, namely, a combustion furnace and combustion tubing, and a supply of the usual glass absorption bulbs, measuring vessels, and other appliances commonly employed in organic analysis.

SUBJECT XII.—GEOLOGY.

First Stage or Elementary Course.

A.—Preliminary Subjects.

a. Basis of Geology.—Definition of Geology. Its objects. Waste of land now brought about by mechanical causes,—wind, rain, running water, frost, snow, glaciers, and the sea. Origin of boulders, rounded pebbles, grains of sand, and mud. Detritus carried in mechanical suspension in rivers. The cementing substances that bind together incoherent rock-forming materials. Deposition of strata now going on in seas, estuaries, and lakes, from sediments formed mechanically. Other strata formed in part or entirely of organic remains. Proof that stratified rocks generally were formed by deposition from water, as above. That strata have been successively deposited and are of various ages. That strata of different ages are characterised by special fossils. The principal tests of the relative ages of stratified rocks. Definition of the term igneous or eruptive as applied to rocks.

b. Common Geological terms.—Definition of "Crust of the Earth," clay, shale, marl, marl-slate, sand, sandstone, conglomerate, breccia, limestone, lava, volcanic ashes; stratum or bed; a formation, group of formations. Recent, Cainozoic (Tertiary), Mesozoic (Secondary), Palæozoic, and Archæan (or Pre-Cambrian) formations. Outcrop, dip, strike. Horizontal, inclined, vertical strata. Anticlinal and synclinal curves. Contorted and inverted strata. Basin. Outlier, Inlier, Conformable and unconformable stratification. Diagonal or cross-stratification. Overlap, joint. Fissile or flaggy structure, lamination, foliation, cleavage. Fault, normal and reversed, thrust-plane, lode, vein, dyke. Hade. Ripple-marks, rain-pittings, sun-cracks, and their indications.

c. Composition of principal rocks and the common rock-forming minerals.—Minerals that form Granites. Syenites. Diorites (Greenstones), Dolerites (Basalts), Volcanic Ashes (Tuffs), &c., Serpentine; Gneiss and mica-schist. Limestones, Dolomite, and Calcareous Tufa; Clays, Shales, Slates, Sandstones, Grits, Ironstone, Flint, Chert, &c.; Coal, what originally formed from. Colouring matter of rocks. Formation and mode of occurrence of nodules and nodular concretions. Characters of the more important igneous, aqueous, and metamorphic rocks.

d. Disintegration and Solution.—Disintegration and solution of minerals composing rocks; origin of soils. Springs mineral and springs thermal, and substances in chemical solution in rivers, lakes, and the sea.

e. Snow and Ice.—How glaciers are formed. Movement of glaciers and transport of matter on their surfaces. Moraines. Roches moutonnées. Perched blocks. Boulder-clay, and other glacial deposits. Erosion of rocks over which glaciers flow. Icebergs, whence derived. Transport of matter from cold to warmer latitudes by icebergs.

f. Rivers.—Cutting out of valleys, and cañons, by rivers. Terraces Transport of material seaward, and formation of Deltas and bars.

g. Marine Denudation, Transport and Consolidation of Material and Fossilization.—Waste of sea-coasts by breakers and by help of landslips. Rounding of pebbles and grains of sand on shores by the action of wind, directly on land—indirectly in water, and in streams. Formation of Shingle-beaches and of Sand-dunes. The effect of long-continued marine denudation on land; formation of bays and head-lands, &c. Distribution of sediments derived from land over sea-bottoms, forming modern marine strata. Consolidation of strata by pressure, chemical changes, the introduction of cementing matter, and by heat. Fossils. Preservation of shells, &c. in (marine, lacustrine, and estuarine) deposits, in caverns, and in alluvium, and in and under peat, blown sand, shell-mounds, and volcanic ashes. Fossil casts. Modes of fossilization.

h. Internal Heat, Volcanos, Earthquakes and other Movements of the Earth's Crust.—Evidence of the gradual sinking and rising of the sea-bottom. Coral Reefs:—Fringing-reefs, barrier-reefs, atolls. Volcanos and their connexion with some areas of upheaval of land above the sea. Raised Beaches. The structure of Volcanos. Earthquakes. General structure of mountain chains. The evidence of the existence of so-called central heat in the earth. Probable thickness of the Earth's crust. Change of sedimentary strata —such as shale and slate, sandstone, limestone, &c., into mica-schist, gneiss, quartzite, crystalline limestone, &c. (metamorphism). Origin of gneiss, &c. by alteration of igneous masses.

B.—Classification of Animal and Vegetable Life.

i. A rudimentary acquaintance with the meaning of the names of the *main divisions* of the animal and vegetable kingdoms; more especially of those forms of life which are found as fossils. Geological horizons or range of especially important genera of fossils.

C.—Palæozoic Series.

Succession of Strata, Igneous Rocks, &c. (as developed in Britain), noting the more important economic products:—Coal, ironstone, and ores of other metals, salt, building-stone, slates, road-stones, &c.

k. Oldest known strata or the Archæan or Pre-Cambrian rocks. Their metamorphic character.

l. Cambrian and Silurian.—Their main sub-divisions, and their more characteristic groups of fossils:—Graptolites, Trilobites; relative abundance of Brachiopoda. First appearance of fish, and of land-plants.

m. Old Red Sandstone and Devonian.—Differences between them, and the areas in which each occurs. Supposed fresh-water character of the Old Red Sandstone; its characteristic fossils.

n. CARBONIFEROUS.—The ordinary succession of these strata in Wales and the South-west of England. The corals, shells, and fish-remains found in the Carboniferous Limestone, and other beds. The succession of strata; sections found in the Coal-measures. The Underclay generally below beds of coal. Formation of coal. How there came to be many beds of coal in one coalfield with beds of shale, ironstone, and sandstone between.

o. PERMIAN.—Order of succession in England, and relation to the Carboniferous strata below and to the Triassic strata above. The chief fossils of the Magnesian Limestone.

D.—Mesozoic or Secondary Series.

p. NEW RED SANDSTONE OR TRIAS.—British divisions: 1st. New Red Sandstone (Bunter); 2nd. New Red Marl (Keuper). Great changes of life in passing from Palæozoic to Mesozoic times. Origin of Rock-Salt by evaporation of salt water. Gypsum of the Red Marl.

q. PENARTH OR RHÆTIC BEDS.—

r. LIAS AND OOLITES.—(Jurassic.) The names of the chief formations. General characters of the rocks. Great development of life of these periods. Leading marine fossils of the Lias, and land-plants and Insects. Common genera of Brachiopoda and Conchifera, Gasteropoda, Cephalopoda, Echinodermata, Fish, and Reptiles. Leading fossils of the Oolites as above, and also Mammalia. Proofs of land in the neighbourhood of the British Liassic, and Oolitic seas.

s. PURBECK AND WEALDEN.—Their estuarine and freshwater characters, and proofs of these from the fossils. Generic names of leading fossils. Proofs of the existence of a neighbouring large continent.

t. CRETACEOUS SERIES.—British divisions, Lower and Upper, and their subdivisions. The nature of the strata and general grouping of fossils (as in *r* above). Differences when compared with Oolitic genera and species.

E.—Cainozoic or Tertiary Series.

u. EOCENE OR LOWER TERTIARY. — Meaning of the terms Eocene Oligocene, Miocene, and Pliocene. Areas occupied by the English Eocene strata, and their divisions. Their fossils—freshwater, estuarine, and marine. Fluvio-marine series of the Upper Eocene (or Oligocene) of the Hampshire Basin. Plant-beds of Bovey-Tracey, Bournemouth, Alum Bay, Mull, &c. (some of these formerly classed as Miocene). Remains of insects, mammals, reptiles, molluscs, &c.

v. PLIOCENE, CRAG, &c.—Divisions of the British Crag, characters, and fossils, marine and terrestrial. Economic products. Proportions of recent species in the different members of the Crag. The Forest Bed beneath the Boulder Clay, and its Flora, terrestrial Fauna, and shells.

w. GLACIAL EPOCH, AND STRATA LATER THAN THE CRAG.—The glaciers of the Glacial Period. The origin and nature of the Boulder Clays. Other proofs of a cold climate, and the marine and terrestrial Fauna of the period.

x. POST-PLIOCENE, POST-TERTIARY, AND RECENT. — Alluvium, Peat, and other deposits now forming. Raised Beaches. Submerged or Submarine Forests. River Terraces, Bone Caves and their contents, &c.

SECOND STAGE OR ADVANCED COURSE.

A.—Preliminary Subjects or Principles.

1. All contained in *a* of the elementary stage.
2. All contained in *b*.

3. All contained in c. The chemical composition and crystallographic forms of the different species of rock-forming minerals included in the Felspar group, the Amphibole group, the Pyroxene group, and the Mica group. Garnet, Tourmaline (Schorl), Apatite, Epidote, Chlorite. Pyrites, Titaniferous and Magnetic iron, Quartz and other varieties of silica; Calcite, Zeolites, &c. The different varieties of Coal. Mode of occurrence of the principal ores. Principal varieties of rocks, sedimentary, eruptive, and metamorphic. Their mode of occurrence, mineral composition, and microscopic structure. Their industrial applications. Nature of metamorphism.

4. CHEMICAL DISINTEGRATION.—Chemical disintegration of rocks on a large scale; action of water charged with carbonic acid upon limestones. Weathering of granite rocks, and formation of kaolin. Origin of mineral and thermal springs, and of the substances in solution in them and in rivers, seas, and other waters. Cementation of incoherent rock-forming matter. Remains of testacea and other marine and fresh-water animals, whence derived, and how strata are formed of these.

5. EFFECTS OF SNOW AND ICE.—Glaciers, and how they are formed. Change of snow into solid ice. Stratification and veined structure of ice. Inclinations of beds and surfaces of glaciers. Why glaciers flow. Rates of progress. Crevasses. Moraines—lateral, medial, terminal, and how they are formed. Work done by glaciers. Erosion of rocks under glaciers and its results. Flow of water from lower ends of glaciers. Destruction of terminal moraines, and circumstances that induce their occasional preservation. Oscillation of size of glaciers. Deepening of valleys. Signs left by glaciers that have disappeared. Icebergs of Arctic and Antarctic regions and of South America; how formed. Ocean currents. Transport of matter by icebergs, and its distribution over existing sea-bottoms. Transport of detritus by coast-ice and river-ice.

SUBAERIAL, AERIAL, AND ÆOLIAN ROCKS.

6. RAIN, SPRINGS, AND LANDSLIPS.—Action of wind and running water. Landslips in mountainous and hilly regions, and landslips on sea-coasts. Their effect in bringing matter within the influence of running water and of the sea.

7. RIVERS.—Erosive and transporting power of brooks and rivers. Their influence in forming gorges, *cañons*, and valleys. Origin of waterfalls. Amount of matter carried seaward by great rivers such as the Nile, the Ganges, the Mississippi, &c. The mode of formation and gradual growth of Deltas and their possible age. Filling up of lakes by sediments. General effects on the form of the ground and lowering of level of continental and smaller areas by combined effects of chemical disintegration, and mechanical disintegration by rain, rivers, frost, snow, and glacier-ice.

8. MARINE DENUDATION.—Waste of sea-coasts by breakers and landslips. Formation of pebbles and sand on sea-coasts. Power of breakers in moving sand and shingle, and large blocks of stone. Effect of prevalent winds on waste and transport of material along shores. Silting up of estuaries. Effect of groynes and other artificial obstructions on coasts. Warping of alluvial tidal flats. Forms of sea-cliffs, and origin of many bays and headlands. Comparison of sea-cliffs with escarpments. Origin of great plains of marine denudation by combined action of breakers and landslips; and general lowering by waste of the interior of countries. Subsequent upheaval of such plains and renewed scooping out of valleys. Origin of certain tablelands and their valleys.

9. DISTRIBUTION OF MATERIAL IN SEA, &C. FORMING MODERN STRATA.—Transport of matter by great marine currents, passing mouths of rivers and along coasts. Transporting powers of tidal currents. Sorting action of the sea in arranging sediments along its bottom. Icebergs (see 5). Modern formation by these causes of beds of clay, sand, gravel, and boulder beds, and mixtures of these. Deep-sea deposits of modern seas; and wide

distribution of deep-sea forms of life with localization of littoral forms; importance of this distinction in Geology. Volcanic Ashes falling in sea and lakes. General formation of lacustrine strata. Formation of beds of limestone by organic bodies in seas, lakes, and lagoons. Coral Reefs (see 11). Salts carried in solution by rivers into lakes; evaporation of such solutions, concentration and precipitation. Origin of Rock-Salt, &c.

10. Fossilization and Consolidation of Strata.—Shells and other marine organic remains buried in sediments. Also Terrestrial Plants. Worm-burrows. Terrestrial animals. Organic remains in lakes and river-deltas, in alluvial beds and brickearths; in and under peat, under blown sand, and in volcanic ashes and under lavas. Formation of sediments by foraminifera, &c. in deep seas. Modes of distinguishing rocks formed in estuaries, deltas, and seas. Consolidation of strata by pressure, infiltrations, and precipitations, chemical decomposition and recomposition, and by heat.

11. Subterranean Heat, Volcanos, Earthquakes and other Movements of the Earth's Crust.—Theory of Coral Reefs. Fringing Reefs, Barrier Reefs. Atolls, and proofs of gradual subsidence of the sea-bottom. Recent views on this subject. Connexion of coral reefs with the volcanic islands of the Pacific Ocean and areas of partial upheaval. Upheaval of the west coast of South America. Oscillations of level on the coast of the Baltic, Greenland, &c. Raised beaches.

Theories of central heat, how inferred. Radiation of heat from the Earth, consolidation, and theory of the formation and shrinkage of its crust. Thickness of the Earth's crust. External phenomena of Volcanos, and theories of volcanic action. Ages of the various volcanic rocks in the British Islands. Earthquakes. Oscillations of level accompanying earthquakes.

Metamorphism of rocks. Contact-Metamorphism. Regional-Metamorphism. Influence of heated water in producing metamorphism. Theory of slaty cleavage; passage of shales, clayslate, sandstone, limestone, and their intermediate gradations into mica-schist, chlorite-schist, various kinds of gneissic rocks, granulite, quartzite, crystalline limestones, &c. Special development of distinct minerals in rock-masses. Relation of the above to gradual subsidence of rock-masses and accumulation of strata above them. Metamorphism of Igneous Rocks, and the supposed conversion of such rocks into schists, gneiss, &c., by heat, pressure, earth-movements, &c. Origin of mountain chains. Disturbance and contortion of strata in successive stages, and probable causes of these phenomena. Relative ages of mountain chains.

B.—Classification of Animal and Vegetable Life.

12. All contained in *i* of the Elementary stage, together with a general knowledge of the orders of Mammals, Birds, Reptiles, Amphibians, Fish, Insects, &c., Crustacea, Echinodermata, Cephalopoda, Pteropoda, Gasteropoda, Conchifera, Brachiopoda, Polyzoa, Cœlenterata, Protozoa, &c., and the classes and orders of the Vegetable Kingdom. Relative importance of these groups in correlating strata.

Succession of Strata, Igneous Rocks, &c.

In all cases attention should be paid to the proofs of contemporaneous volcanic action; to the physical geography of the areas occupied by the various formations; and to the chief economic products which they yield.

C.—Palæozoic Series.

13. The Archæan and Metamorphic rocks of the British Isles, and of the Continents of Europe and America. Theories as to their origin and relative ages.

14. Cambrian and Silurian.—Different views as to the classification of these strata, their main subdivisions and characteristic fossils; unconformities

in the series, and the relation of these unconformities to breaks in succession of life.

15. Old Red Sandstone and Devonian.—Passage of Upper Silurian into Lower Old Red Sandstone in Wales and on its borders. Disappearance of the life of the Silurian period. The land that existed in Scandinavia and Britain before the deposition of the Old Red Sandstone, and around and on which the Old Red beds were deposited. Fish of the lower Old Red Sandstone; their distinctive characters.

Upper Old Red Sandstone.—Lithological characters, fish, shells, and plants. Cornstones. Unconformity of the Upper on the Lower Old Red Sandstone, and approximate or actual passage of the former into the Lower Carboniferous strata. Nature of the waters in which the Old Red Sandstone formations were probably deposited.

Devonian.—The division of these strata commonly made into Lower, Middle, and Upper Devonian. The marked difference of conditions of deposit shown in the general nature of their fossils as compared with the Old Red Sandstone, viz., the Fish of the Old Red Sandstone, and the Corals, marine bivalve and univalve shells, Cephalopoda and Trilobites of the Devonian strata. The stratigraphical relation of the Devonian strata to the Silurian rocks of Devon and Cornwall. The relation of the so-called Upper Devonian beds to the Carboniferous strata. The appearance of new genera and species in the Devonian rocks.

16. Carboniferous.—Succession of Carboniferous strata in South Wales, and its borders, and in the south-west of England, viz., Lower. Limestone Shale, Carboniferous Limestone, Upper Limestone Shale, Millstone Grit, and Coal Measures. The lithological characters of these and their fossils—marine, freshwater, and terrestrial. The manner in which the beds below the Coal Measures were accumulated. The manner of the formation of the Coal Measures, the peculiar strata beneath each bed (or most beds) of Coal, the nature of the plants that formed the coal, their mode of growth, and the cause of the succession of beds of coal in thick series of strata. The gradual change of the above-mentioned Carboniferous strata into a set of beds differently arranged in their stratification, especially in their lower members, proceeding northwards through Lancashire and Yorkshire into Northumberland, and Scotland. The physical causes that produced this difference. The Carboniferous series as developed in Ireland. The Carboniferous rocks of the continents of Europe and North America. Their resemblances to those of the British Islands. Climate, its average uniformity in space and time during this epoch. The surface areas occupied by the European Carboniferous strata now. The areas where they may be concealed under newer formations. The areas where they were originally formed, *i.e.*, which they spread over before being reduced to their present limits by denudation. The disturbances of the Carboniferous rocks, and the reasons why coal-fields (like parts of many other formations) so often lie in basin-shaped areas. Various kinds of coal, such as the varieties of coal commonly called bituminous, cannel, and anthracite. The chemical changes that vegetation underwent in its conversion into coal, first on the surface, and afterwards under pressure. The passage of bituminous coal into anthracite, and the connexion of this with highly disturbed areas. Development of Crustacea of the Carboniferous rocks as distinguished from those of the Devonian and Silurian periods. Prevalence of certain genera of Brachiopoda and Conchifera, and relative proportions of these in the Carboniferous rocks when compared with older formations. Fish and Reptiles of the Carboniferous rocks. Footprints, Rain-drops, Land-shells, and Insects, and what they indicate. Ironstones. Mineral veins in Carboniferous Limestone series. Coal, hæmatite and lead-ore in the North of England.

17. Permian.—Succession in Britain, Germany, and Russia. 1. The Rothliegende, its structure, and the supposed evidences of the glacial agencies by which parts of it were deposited. 2. The Kupferschiefer of Germany and Marl-slate of England, with mineral contents, fish, &c. 3. The Magnesian Limestone (Zechstein), its mineral character and composition; its fossils; evidence of their Palæozoic character partial community of species, and numbers and

size when compared with the genera and species of the Carboniferous Limestone. Cause of this. Unconformity on the Carboniferous and older rocks; submersion of old lands during its deposition; bearing of this on conglomeratic and brecciated structure of the Rothliegende and the general development of the life of the period, including plants and reptiles. Relations of the Permian to the Carboniferous, and to the Trias in Britain and on the Continent.

D.—Mesozoic or Secondary Series.

18. Divisions of Trias, or New Red Sandstone series.—Great changes of fossil forms in passing from Permian to New Red Sandstone. Great development of Conchifera, and decrease of genera of Brachiopoda. The relation of this to lapse of time, as shown by frequent unconformity, and continued prevalence in later times of many of these early Mesozoic types. The generally unfossiliferous character of the New Red Sandstone beds (Bunter) and heir minor divisions in England. The absence in England of the Muschelkalk. Its fossils. The minor divisions of the New Red Marl (Keuper). Its fossil plants and reptile-bones and footprints. Microlestes. Rain-pittings, Ripple-marks, and Sun-cracks. The rock-salt, gypsum, &c. of this formation, and how they were deposited. Theory of inland salt-lakes or seas of the present day, and the bearing of this and of the above-named marks of rain-drops and footprints on the point. Those parts of the British Islands that formed land before and during the New Red Sandstone period.

19. Penarth or Rhætic Beds.—Intermediate between New Red Marl and Lower Lias. Gradual passage of nearly unfossiliferous red marls into these more fossiliferous strata. Character and names of some of the common fossils. Their affinities with Liassic forms, and the conformable passage into that formation in Britain.

20. Lias and Oolites (Jurassic).—Names of the several formations of the Lias and Oolites between the Lower Lias and the Purbeck Beds in serial order. Lithological characters of the Liassic divisions. Fossils of the different formations. The distinctive characters of some of these, their relative numbers compared with the same classes in the Palæozoic rocks. Nature of the connexion of the Lias with the Inferior Oolite. Lithological characters of the Oolitic formations and the uses to which the rocks of the different divisions are applied. Marine fossils of the different sub-divisions of the above-named formations; also Mammalia. Change in character of the Oolitic rocks when traced northwards through England; causes of this change. Evidences of the existence of older land in the neighbourhood of the Liassic and Oolitic seas, and of the climate of the period as inferred from the remains of plants and animals. Names of the most characteristic genera of the fossils of the Lias and Oolites, especially with reference to their prevalence: some notably characteristic species and the names of some of them. Jurassic strata of the continent of Europe; the Jura and the Alps; the fossils of Solenhofen. Disturbance and metamorphism of Jurassic strata. Contrast the life of these epochs with similar developments in Palæozoic epochs.

21. Purbeck and Wealden.—Their general fresh-water nature and marine interstratifications. Extent of these formations in England and on the Continent. Their characters and thickness. Fossils of the Purbeck strata. Plants, land-insects, mammals, fish, reptiles, univalve and bivalve shells, and crustaceans. Fossils of the Wealden formations as above. Evidences of the upheaval of extensive tracts of land during the period, and the manner in which the Purbeck and Wealden beds were deposited. Relation of the Purbeck to the Oolites, and of the Wealden to the Cretaceous.

22. Cretaceous series.—Description of the British divisions and subdivisions. Their lithological characters; and relations of Wealden beds to marine Cretaceous beds in the Wealden and area in the Isle of Wight. Fossils

of the formations noticed in the same way as those of the Oolitic strata. Neocomian beds of the Continent and their equivalents in Britain. Lower and Middle Neocomian of Yorkshire, &c.—the marine equivalents of the Wealden Beds. Upper Neocomian (Lower Greensand) of South-east of England. Gault and Upper Greensand. Chloritic Marl. The Chalk, by what organic bodies chiefly formed. Comparison with similar deposits forming in existing oceans. Nature and mode of occurrence of flints in chalk, and vein, and tabular flints. Resemblances and differences of the genera and species of the Oolitic and Cretaceous epochs, and the bearings these have on lapse of time between the deposition of the Portland Oolite and the commencement of the marine Cretaceous series. Continental Cretaceous geology generally. Hippurite Limestone. Highest Cretaceous rocks unknown in Britain. Maestricht beds and Chalk of Faxoe, Denmark. Upper Cretaceous beds and flora of Aix-la-Chapelle. Account of them. Cretaceous strata of America, and relations of these to Tertiary beds.

E.—Cainozoic or Tertiary.

23. Eocene or Lower Tertiary. — Meaning of the terms Eocene, Oligocene, Miocene, and Pliocene. Grouping of greater divisions and subdivisions of the English and French strata as usually given in text-books. Areas occupied by the English and French Eocene strata. Evidence of the upheaval of the Chalk and older strata of Western Europe before the Eocene period. The evidence shown by fossils of the manner in which the different formations or parts of formations were deposited; 1st, into three broad divisions, estuarine and fluvio-marine below; 2nd, marine in the middle; and 3rd, fresh-water, estuarine and fluvio-marine above. Correlation of this highest series with the Oligocene beds of the Continent. Evidences of land and its nature drawn from plants and from mammalian remains. The nummulitic beds of England, the Continent of Europe, Asia, and Africa. Evidences of climates of Eocene times, as indicated by shells, reptiles, and plants, &c. Original extension and subsequent denudation of Eocene beds in Britain.

Plant-Beds of our British Tertiary Series; associated Igneous rocks of Antrim, Mull, &c. Some of these formerly referred to the Miocene. Reasons for and against this view.

24. Miocene or Middle Tertiary strata.—Nature of the strata and their fossils. French marine and freshwater strata and igneous rocks. The fossils of the former and the Mammalia of the period. Miocene beds of the Rhine, Switzerland, Bohemia, and other parts of the continent of Europe and of the Arctic Regions. Their divisions, lithological characters, and fossils. Brown-coal of Germany, &c.; reference of some of the lower beds to the Oligocene. Disturbances of the Alps and Jura before and after the close of the Miocene epoch. Miocene rocks of India and their fossils.

25. Pliocene Strata, Crag, &c.—(See *v*,) and in addition proofs of Britain having been joined to the Continent before the Crag epoch. Crag of Belgium. Pliocene beds of Italy.

26. Post-Pliocene or Post-Tertiary, Glacial Epoch, and Strata later than the Crag.—Old land-surface of Britain later than the Crag,—Forest beds, their plants, mammalia, and shells. The Glacial period. Great glaciers before the deposition of the Boulder Drift in the northern and southern hemispheres generally, and in Switzerland and other mountain ranges specially. The signs of this. Boulder beds and Arctic shells. Minor glaciers during and after the deposition of the boulder beds. Their signs. Erosion of valleys by ancient glaciers. Theory of the formation of rock-bound basins by glaciers and of other lakes by boulder beds and eskers or kaims. General nature of the fauna of the period. Union of the British Islands and their union with the continent before and after the Glacial Epoch. Theories of the causes that produce this glacial period and of glacial periods in general. Loess of the Rhine and other rivers, brick-earths river-gravels, and alluvia of various ages. Mammalian and other bones in these in Europe, Asia, and America. Bone

Caves and the manner of the preservation of their fossil contents. Relics of man and his works in caves, river-deposits, shell-mounds of Denmark, &c., and in Swiss and other lakes. Contours of ground before and after the Glacial Period. Origin of River-valleys. Pre-glacial and post-glacial valleys. River Terraces. Raised Beaches, &c.

27. Theories that have been proposed to explain the distribution of life in individual formations and throughout the whole geological series; or the origin, increase, distribution, and disappearance of species and genera commonly so called. The relations of the life of successive formations to each other generally. Relations of existing faunas and floras of the world to those of Miocene, Pliocene, and Post-pliocene age.

28. Water-bearing strata and underground drainage. Perennial, intermittent, and thermal springs. Artesian and other wells. Soils and their relations to the underlying beds or to drift deposits. Origin of mineral veins and lodes. Rocks in which ores are found, and mode of occurrence of ores in beds, lodes, and superficial detritus. The rules that ought to guide the miner in sinking for coal and other minerals, when the beds in which they lie are concealed by overlying and unconformable strata.

Examination for Honours.

In addition to the foregoing, candidates for Honours may be expected to be acquainted with any subject treated of in first-class standard manuals, with questions bearing on the history of Geology on the present state of geological opinion on such subjects as Vulcanicity, the probable condition of the Earth's interior, and the action of ice as a geological agent; on the nature and effects of metamorphism; and on microscopic petrography.

The Examination will consist of a preliminary written paper, and those who qualify therein may be required to attend a practical examination at South Kensington at a subsequent date.

SUBJECT XIII.—MINERALOGY.

Practical Work.

Each candidate for examination in Mineralogy must be provided with a set of the following reagents and apparatus. This set should be of a portable character so as to be available for use in any examination room.

- Gas, Oil, or Candle flame.
- Mouth Blowpipe.
- Platinum Wire.
- „ Foil.
- Charcoal.
- Open and closed Glass Tubes.
- Silver Foil or old Silver Coin.
- Magnet.
- Knife.
- Lens.
- Tinfoil.
- Cobalt Glass.
- Copper Wire.
- Borax.
- Carbonate of Soda.
- Nitre.
- Bisulphate of Potash.
- Microcosmic Salt.
- Nitrate of Cobalt.
- Hydrochloric Acid.
- Litmus Paper, red and blue.

Specimens of minerals will be sent for an examination in which the blowpipe and dry reagents will be used. The specimens sent to be examined will be in the state of coarse powder, and are to be tested as to their physical and chemical properties in accordance with the syllabus so far as the use of the above-mentioned apparatus and reagents will permit.

In the Elementary Stage three substances will be sent for each student to examine; in the Advanced Stage, three substances, and in Honours the

number of substances given will depend upon the number of the elements which each specimen may contain. In the Elementary Stage the candidate will be required to detect the presence of not more than two elements (Hydrogen and Oxygen excepted) in any one specimen. In the Advanced Stage, three or four elements may be present, and should be identified, in each specimen, in addition to Hydrogen and Oxygen. The comparative fusibility, the effect of heating in closed and open tubes, the colour given to the flame the incrustation on charcoal, the effects of fusing metallic oxides with borax, and, for the Advanced Stage, with microsmic salt, should be clearly stated. Candidates in Honours will be required to make a full and complete examination of the specimens sent for their use.

First Stage or Elementary Course.

A. Instruction in this subject should commence with a distinct understanding of the characters and circumstances by which minerals, properly so called, are to be distinguished from other inorganic substances, and of the position of this science in relation to the collateral sciences of physics, chemistry, and geology. Definitions of a mineral and of a crystal. The conditions crystalline and amorphous. Occurrence of other more or less regular forms. Distinction of compound masses or mixtures of minerals.

B. Crystallography, as the essential means of appreciating the forms naturally assumed, under favourable conditions, by almost all inorganic bodies of definite composition, must commence with the needful definitions; faces, edges, and solid angles; plane figures of three, four, five, six, and eight sides; the names and chief features of the more important geometrical solid figures which occur among crystals; the object of referring the faces to systems of axes, and the various directions in which these may be placed; symmetry of crystals; planes and axes of symmetry; the symmetry of the six crystallographic systems.

Method of drawing crystals isometrically.

Relation of the hemihedral to holohedral forms.

The grounds for grouping the various crystal forms into six systems.

Laws by which the derivation of one form from another within the limits of the same system is determined.

Complex or modified crystals may be regarded as combinations of the faces of two or more simple forms.

The leading figures of the six systems to be studied, with frequent practice in drawing, plane projection being recommended first.

Parallel grouping of crystals.

Twin crystals and hemitropes; the relative position of the axes of their several portions. Definition of the terms twinning-plane, twin axis, and plane of composition. A plane of symmetry is never a twinning-plane.

Irregularities to which the surfaces of crystal faces are subject, certain angular elements remaining constant; measurement of these latter by instruments. Principles of the contact, and of the reflecting goniometer. Construction of Miller's simple reflecting goniometer.

C. Aggregation, or natural grouping of crystals, especially with reference to structure and general form of masses of the useful minerals and of crystalline rocks.

D. Other physical properties.—The cleavage of crystallised substances, and its relation to crystalline form. Fracture, its various characters. Comparative hardness, how best determined. Different qualities of tenacity. Specific gravity of solids, how determined; the ordinary balance, the specific gravity bottle, Jolly's spring balance, Walker's balance.

Property of magnetism; what substances are capable of being attracted by a magnet, and what is the comparative intensity of the effect. Polarity. Influence of certain minerals disseminated in rocks on the correctness of surveys. Electrical properties of minerals.

Peculiarities of smell, taste, and feeling which distinguish a limited number of minerals.

E. Optical characters.—Single and double refraction, and their relation to certain crystallographical systems.

Different degrees of lustre and transparency.

Colour essential in some species, not so in others; varieties of colour, how far they are capable of definition.

Phosphorescence as produced by different methods and exhibited by certain minerals.

F. Chemical characters.—Simple or elementary substances; some of them occur as minerals; their symbols and the derivation of the same. Equivalents; chemical combinations; principal groups of these occurring in the mineral kingdom.

Dimorphism of particular substances, accompanied by a difference in other physical characters besides form.

The employment of acids in the discrimination of minerals.

The blowpipe, its form and uses; the reducing and the oxidizing flames. Trial of comparative fusibility, effects of heating in open and closed tubes, of the colour given to the flame, the incrustation on charcoal; the effects of fusing various metallic oxides with beads of borax glass.

Specimens will be sent for an examination in which the blowpipe and dry reagents will be used.

Pseudomorphism.—The phenomena presented by minerals which have the composition of one mineral coupled with the form of another Fossilization or petrifaction.

G. General requirements of a system of classification of minerals.

H. The physiography or systematic description of minerals. This last division should include all the more remarkable varieties as well as species, and should take especial note of the modes of occurrence as well as of the association of particular groups of minerals in certain veins or formations.

It would not be expected that the elementary course should include the description of the rarer substances, or of those species whose characters are not yet well ascertained. Attention should be restricted to the principal species which form the constituents of rocks and those which as ores supply the materials for the production of the useful metals.

Second Stage or Advanced Course.

A. Discussion of the relation of true minerals to other inorganic substances, and how far bodies of organic origin may be classed among minerals.

B. The dependence of the axial system in crystal forms on symmetry. The crystallographical value of a face is the same as that of any plane parallel to it, on the same side of the centre of the crystal. Position of the normals to a face. The methods of indicating the faces, and thence the entire forms of crystals by symbols. Drawing of a sphere of projection in which the poles of the crystal faces may be shown. Convenience of representing in a great circle the poles of a zone of faces. The magnitude of the angle between the normals being the supplement of the mutual inclination of the planes, the first kind of measurement (*i.e.*, between the normals) is adopted by certain authors, and is easily reducible into the other kind. Statement of the angular and linear dimensions requiring to be determined for the description of the simple forms of all the systems after the cubical.

Twin crystals, planes of composition, twin planes, and twin axes; examples of their position in important minerals of the several systems.

C. Reticulated, wiry, and capillary forms, explanations suggested as to their formation. Other peculiarities in grouping.

D. The prevailing directions of cleavage in the several crystallographical systems.

Determination of the specific gravity of a substance contained in a mechanical mixture. Sonstedt's solution; Klein's solution; Mohr's method of taking specific gravities.

Electricity; by what means this property is exhibited in different minerals. Pyroelectricity. Nature of analogous and antilogous poles. Frequent association of pyroelectricity with hemimorphism.

E. Propagation of light; wave lengths; amptitude of vibration; interference, &c. &c. Refraction of light; different positions of the ordinary and extraordinary ray in doubly-refracting bodies. Optic axes, uniaxial, and biaxial crystals. Bisectrices and optic-normal.

Polarized light, its connexion with double refraction. Construction and use of the polariscope.

Polarisation with parallel and with convergent light; axes of optical elasticity. Interference figures of uniaxial and biaxial crystals. Determination of optical sign by means of quarter-undulation-plate and quartz-wedge. Circular polarisation. Pleochroism, and the means of determining the existence of this property in a mineral. Face-colours an axis-colours.

F. Character of the chemical composition of the more complex minerals.

The electro-negative element in chemical combinations has the preponderating effect in influencing the external character.

Isomorphism, illustrated by the principal isomorphous groups of minerals.

Testing of minerals in the moist way simply practicable for qualitative purposes, except in the laboratory.

Treatment of various metallic ores before the blow-pipe.

Pseudomorphous substances as arranged in groups according to the nature and degree of change they have undergone. Change of volume sometimes induced by pseudomorphism.

Discussion of the conditions under which pseudomorphs have been produced.

G. Methods of classification as proposed by the leading authors in mineralogy.

Discussion of the means of defining a species among minerals.

H. Species and varieties of minerals as described in the best manuals. Their occurrence under various circumstances to be particularly studied. The changes in composition wrought by nature (pseudomorphous action), by which one species is converted into another, and the essential points of difference between species much alike in certain characters, will be held of much importance in dealing with the minerals of special value or interest. It is not expected that the memory should be charged with the details of substances of very rare occurrence, or of doubtful independence as species.

Examination for Honours.

The questions will as a general rule be such as are embraced in the above syllabus, but candidates will be required to prove a practical acquaintance with minerals and with crystal forms, and will need to have studied the more advanced works. A knowledge of the microscopic characters of the chief rock-forming minerals should be acquired, and of the newer methods of investigating the physical and chemical nature of minerals.

List of some of the principal Minerals recommended for Study in the Elementary Stage.

Diamond, graphite, anthracite, coal, lignite, amber, borax, sulphur, calcite, aragonite, dolomite, gypsum, anhydrite, apatite, fluorspar, nitre, rock-salt, magnesite, barytes, witherite, celestine, strontianite, corundum and its varieties, spinel, alumstone, cryolite, turquois, quartz and its varieties, chalcedony and its varieties, opal and its varieties, the garnet group, sodalite, leucite, idocrase, zircon, apophyllite, nepheline, tourmaline, beryl and its varieties, the mica group, some of the most common zeolites olivine, andalusite, staurolite, topaz, the pyroxene group, the amphibole group, talc, chlorite, epidote, the felspar group, serpentine, meerschaum, kaolin. A few of the commoner clays. The

chief ores of manganese, arsenic, antimony, bismuth, zinc, tin, lead, iron, copper, mercury, and silver.

The above is only an imperfect list, and it is quite possible that occasionally questions may be set or specimens given for determination in the examination of candidates in the elementary stage which involve some acquaintance with minerals not included in this list, although in such cases they would also relate to well-known minerals, descriptions of which would be found in any elementary text book.

The teacher is recommended to treat the descriptive part of his subject in such a manner that certain important groups of minerals, underlined in the list, may be dealt with in separate lessons, while, as regards the other minerals enumerated, he will find it advantageous to arrange them, where practicable, in isomorphous groups.

A similar method of teaching is also to be recommended for the Advanced stage, but the candidate will in this examination be expected to have a more extended knowledge, not merely of descriptive Mineralogy, but also of the general principles of the science.

SUBJECT XIV.—HUMAN PHYSIOLOGY.*

Syllabus.

First Stage or Elementary Course.

Questions will be confined to the under-mentioned points in the elements of Anatomy and Physiology.

Candidates are expected to have seen the corpuscles of the blood under a microscope, magnifying about three or four hundred diameters. It is also desirable that they should have made themselves acquainted in like manner with the general microscopic characters of the cells constituting epithelium. Other details of structure needing the use of a microscope will not be asked for.

The information demanded under "Chemical Preliminaries" is limited on the one hand to elementary and fundamental chemical principles, as applied to the animal body, and on the other to the important properties of the chief chemical substances composing the body and food; in respect to these points the answers must be precise, but no further chemical knowledge will be required.

No candidate will be allowed to pass who in the answers makes gross errors concerning the general build of the body and the relations of its several parts, the structure and working of the heart and the main facts of the circulation, the mechanical and chemical changes of respiration, the chemical nature of food, its changes in the alimentary canal, and its use in the body.

A. Anatomical Preliminaries.

The general build of the body.

The form, the position, and the uses of the following parts of the skeleton:—skull, vertebræ, ribs, sternum; scapula, clavicle, humerus, radius, ulna, carpus, metacarpus, phalanges (of the hand); pelvis, femur, tibia, fibula, tarsus, metatarsus, phalanges (of the foot).

The more obvious distinctive characters of skin, mucous membrane, glands, connective tissue, tendon, ligament, cartilage, bone, muscle, and nerve.

The position in the body, and the general form and size, of the following internal organs:—The brain and spinal cord; the pharynx, gullet, stomach, and intestines; the salivary glands, the liver, and the pancreas; the posterior nares, the larynx, trachea, and lungs; the diaphragm; the kidneys and the bladder; the heart and the great vessels; the spleen.

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* *This syllabus has been considerably revised since the last edition.*

B. Chemical Preliminaries.

The simpler chemical properties of carbon, oxygen, hydrogen, and nitrogen; the meaning of the terms "element," "compound," "decomposition," "oxidation," as illustrating elementary chemical principles.

The composition, nature, and properties of air, water, carbon dioxide (carbonic acid), and ammonia.

The chemical elements of which proteids, fats, and carbohydrates are composed; the general chemical properties of these substances, and the relative proportions in which the several elements are present in each of them.

The composition and general nature of urea.

C. General View of the Animal Body in Action.

The movements of the body as the result of muscular action.

Muscular action viewed as chemical change (oxidation) of the muscle, whereby energy is set free, and waste of substance caused.

The blood as the agent which (*a*) removes the waste, and (*b*) supplies fresh nutritive material to make good the waste.

The waste matter in the blood got rid of by the excretory organs. The fresh nutritive material in the blood supplied to it from food by means of the digestive organs.

The control of the muscles by the nervous system, consisting of (*a*) sensory or afferent nerves, (*b*) the brain and spinal cord, (*c*) motor or efferent nerves.

The general functions of the brain and spinal cord.

The maintenance of the erect posture.

Local and general death.

D. Special Physiology.

a. The Blood.

The form, size, and structure of the corpuscles of the blood.

The general composition of the blood.

The phenomena presented by blood drawn from the body; clotting of blood.

b. The Circulatory System.

The general structure of the heart; the form and arrangement of its chambers; the nature of its walls; the form and position of its valves. The differences between the right and left side of the heart.

The action of the heart as a force-pump.

The mode and action of the valves during the heart-beat.

The general differences between arteries, capillaries, and veins.

The course of the circulation and the reason why the blood moves in only one direction.

The characters of and differences in the blood-flow in arteries, capillaries, and veins.

The meaning of the "pulse."

The evidence of the circulation obtainable in the living body.

c. The Alimentary System.

The general form and arrangement of the alimentary canal in its several parts.

The more obvious characters of the mucous coat, and the differences in respect to it between the stomach and the small and large intestine.

The relationship of the salivary and gastric glands, and of the pancreas and liver, to the alimentary canal. The character and uses of their secretions.

The general nature of food. The classification of food stuffs. The changes the several food stuffs respectively undergo in the alimentary canal, and how these are brought about.

The manner in which nutritive matters are absorbed and innutritious matters got rid of from the alimentary canal.

The economy of a mixed diet.

d. The Liver.

Position and general structure of the liver. The blood supply to the liver.

The obvious characters and properties of bile.

e. The Respiratory System.

The arrangement of the ribs, sternum, intercostal muscles, and diaphragm. The manner in which the walls and floor of the chest change their position during the respiratory movements.

Why air enters and leaves the chest during inspiration and expiration respectively.

The course taken by the air when breathing through the nose.

In what respects the air which leaves the lungs differs from that which enters them.

The obvious differences between venous and arterial blood. Where and how venous blood is converted into arterial, and arterial into venous blood in the body. How venous blood can be converted into arterial blood out of the body.

The conditions which give rise to asphyxia.

f. The Urinary System.

The structure of the kidney so far as it is visible to the naked eye.

The composition of urine as far as its chief constituents are concerned; the significance of these as waste products.

g. The Skin.

The obvious differences between the dermis and epidermis.

The general composition of sweat.

The more obvious functions of the skin.

h. Animal Heat.

The sources of the heat of the body. The manner in which heat is distributed through the body, and in which the temperature of the body is regulated.

i. The Muscular System and Animal Mechanics.

The structure of muscle, of tendon, and of bone, so far as it can be made out by the naked eye or a simple lens. The mode of attachment of muscles to bones.

The nature of joints, with examples of ball-and-socket, hinge, and pivot joints.

The different kinds of levers, with examples of them in the body.

The way in which muscles lead to the movements of the body.

k. The Senses.

The different kinds of sensations.

The means of measuring the acuteness of the sense of touch in various parts of the body.

The general structure of the organs of smell and taste, and the manner in which their functions are performed.

The general structural arrangements of the eye-ball. Such characters of the cornea, sclerotic, choroid, iris, aqueous and vitreous humours, crystalline lens and retina as can be observed by ordinary dissection. The uses of the cornea, iris, and crystalline lens.

How the pupil is enlarged and made narrower, and for what purposes.

The change undergone by the lens when looking from a distant to a near object; the object of this change.

The blind spot, and what it teaches.

The essential facts as to the structural arrangements of the ear so far as they are required to explain how sound-waves are conveyed to the nerves of hearing.

l. The Nervous System.

The chief parts into which the brain may be divided.

The structure of the spinal cord so far as it is visible to the naked eye. The arrangement and the functions of the roots of the spinal nerves.

The general way in which the spinal cord is connected to the brain by means of the spinal bulb or medulla oblongata.

The evidence that the spinal cord is capable of effecting reflex action.

The general phenomena presented by an animal deprived of its brain, as illustrating some of the more important functions of the brain.

Second Stage or Advanced Course.

In addition to the preceding, a knowledge of the following subjects, as defined below, will be required.

In this stage, in contrast to the Elementary Stage, a practical acquaintance, by the use of a microscope, with the minute structure of the several tissues and organs is essential; but a knowledge of well-established features only will be required, to the exclusion of all doubtful and controverted details.

a. The Blood and Lymph.

The size and structure of the corpuscles of these fluids. The phenomena which they exhibit. Their probable origin, functions, and fate.

The composition of the blood in detail. The nature of the process of blood-clotting.

The quantity of blood in the body, and its distribution.

The microscopic characters and chemical composition of lymph.

b. The Circulatory System.

The structure of the heart. The general distribution and arrangement of the principal arterial and venous trunks. The minute structure of the heart, arteries, veins, and capillaries. The disposition of the capillaries in the various tissues.

The detailed analysis of the movements constituting a 'beat' of the heart; the changes of form undergone by the several parts of the heart during a cardiac systole, their nature and effects in propelling the contents of the several cavities, and their time relations. The details of the action of the valves of the heart. The sounds of the heart.

The physical properties of the blood vessels. The mechanics of the circulation. Blood-pressure. The circumstances determining the rate of flow. The phenomena of the pulse.

The nervous arrangements of the heart. The nature of the rhythmic movements of the heart; how these are maintained, and how they are modified according to circumstances; the influence of the pneumogastric and of other nerves on the heart.

The vital properties of the blood vessels. The influence of the nervous system on the blood vessels; vaso-motor nerves. The regulation of the blood supply by means of the nervous system. The influences exerted by the walls of the blood vessels on the flow of blood as seen in inflammation.

The structure of the lymphatic vessels and glands, and the connexion of the lymphatic with the blood vascular system. The origin of the lymphatics. The causes which determine the amount of lymph present in the lymphatic spaces, and those which determine the flow of lymph along the lymphatic channels.

c. The Alimentary System.

The structure and functions of the salivary glands. The structure and functions of the tongue, the soft palate, uvula and tonsils. The pharynx and the œsophagus, and the structure of their walls. The stomach, its form; the structure of its walls; its glands and their functions. The divisions of the intestine. The structure of its walls. Villi. Glands. Peyer's patches. The structure and functions of the pancreas. The peritoneum and the nature of the mesentery.

The phenomena of secretion as observed in the salivary glands, pancreas, and other secreting organs, and the manner in which it is governed by the nervous system. The action of the chorda tympani.

The details of the digestive and absorptive processes.

The structure of the liver, and the course of the blood through it. The arrangements of the ducts of the liver. The composition and functions of the bile. The nature, uses, and fate of glycogen.

The structure of the spleen and of the suprarenal, thymus, and thyroid bodies; and the probable uses of these organs.

d. The Respiratory System.

The structure of the thorax. The pleuræ. The structure of the respiratory organs, and the distribution of the blood through them. The analysis of the respiratory movements in detail. The mechanism by which coughing, sneezing, sighing, and hiccoughing are effected. The gases of venous and arterial blood. The physical and chemical processes involved in the conversion of inspired into expired air, and of venous into arterial blood. The respiratory activity of the tissues and the conversion of arterial into venous blood. The quantity of waste products excreted and of oxygen taken in by the lungs in twenty-four hours. The importance of ventilation.

The manner in which the nervous system maintains and regulates the respiratory movements; the respiratory centre. How the nervous mechanism of respiration is affected (1) by nervous influences, (2) by chemical changes in the blood. The phenomena of dyspnœa and asphyxia, how they are brought about.

The influence of the respiratory movements on the circulation.

e. The Urinary System.

The minute structure of the kidney, ureter, and bladder.

The circulation in the kidney, and the changes which the blood undergoes in passing through it.

The nature of the secretory activity of the kidneys in relationship to the glomeruli and tubules, and the circumstances which affect it. The history of urea.

The quantity and nature of the waste products of all kinds excreted by the kidneys in 24 hours.

f. The Skin.

The minute structure of the skin, and of the hairs, nails, and glands connected with it.

The quantity and nature of the waste products excreted by the skin in 24 hours.

The regulation of sweating by the direct action of the nervous system.

g. Nutrition.

The statistics of nutrition; the income and output of the body, how they are balanced.

The special effects and uses of proteid, gelatinous, fatty, and carbohydrate food stuffs. The changes in the chemical composition of the body resulting from

an excess or deficiency (1) of proteid, (2) of non-nitrogenous food; the effects of starvation. Urea as a measure of the nitrogenous changes of the body. The effects of exercise on the chemical changes and composition of the body. The part played in nutrition by saline bodies.

The energy of the body, its source and expenditure; the amount and character of the daily expenditure.

The production in and the loss of heat from the body; their balance during health, how maintained and regulated by changes (1) in the amount of loss, (2) in the amount of production. The part in this regulation played by the nervous system. The failure of this regulation of heat; the temperature of fever.

h. The Muscular System and Animal Mechanics.

The minute structure of cartilage, bone, connective tissue, and muscle. Cilia and ciliary action.

The changes, physical, chemical, and structural, which take place in a muscle during contraction. The characters of a simple and of a tetanic contraction. Rigor mortis.

The mechanism of standing, walking, running, and jumping.

The structure and working of the larynx.

The mode in which vowel and consonantal sounds and articulate speech are produced.

i. The Senses.

The structure of the papillæ of the skin and of tactile-corpuscles, end-bulbs, and other nerve endings in the skin. Pacinian corpuscles.

The localisation of touch. The sense of pressure, pain, and temperature. The muscular sense.

The minute structure and nervous supply of the tongue as an organ of taste. The structure of taste bulbs. Sensations of taste.

The structure of the olfactory organ. The nature and extent of the air-chambers connected with it. The minute structure of the olfactory (Schneiderian) mucous-membrane and of the olfactory nerve-fibres. Sensations of smell.

The minute structure of the various parts of the eye-ball.

The formation of the image on the retina.

The conditions of distinct vision. Accommodation.

Movements of the pupil. Movements of the eye-ball. Binocular vision. Judgments of distance, form, and solidity.

Evidence that visual impressions begin in the rods and cones.

Colour-vision and colour-blindness.

The structural arrangements of the organ of hearing. The outer-ear. The structure and functions of the middle-ear. The minute structure of the inner-ear.

Auditory sensations. Use of two ears.

k. The Nervous System.

The minute structure of nerves; medullated and non-medullated nerve-fibres. The minute structure of ganglia.

The sympathetic system, its structure and its anatomical and physiological relations to the cerebro-spinal system.

The arrangement and structure of the investments of the brain and spinal cord. The more important structural differences observable in different parts of the spinal cord.

The conduction of motor (volitional) and sensory impulses along the cord.

The general structure of the brain, including the relation and connections of its principal parts, namely, spinal bulb (medulla oblongata), its pyramids; cerebellum, pons varolii, crura cerebri, corpora quadrigemina, optic thalami, corpora striata, the fibres of the cerebral hemispheres, and the internal capsule. The relations of the several ventricles. The minute structure of the cerebral cortex.

The relations of the olfactory bulb. The central connections of the optic nerves.

The origins and general functions of the other cranial nerves.

The more important functions of the spinal bulb or medulla oblongata.

The localisation of function in the cerebral cortex.

The maintenance of equilibrium, and its relationship to the semicircular canals.

2. Reproduction.

The mode in which the fœtus is nourished.

The main features of the fœtal circulation; and the changes in the circulation which takes place at birth.

The lacteal glands and lactation.

Examination for Honours.

In this examination, questions will be set at the discretion of the examiner, who will have regard to the state of teaching of physiology in the country, and the means of acquiring information.

The Examination will consist of a preliminary written paper, and those who qualify therein may be required to attend a practical examination at South Kensington at a subsequent date.

It does not seem to be sufficiently understood that the standard of examination for honours is very much higher than that for the second or advanced stage. Candidates attempt the honours paper whose answers show that they are but ill prepared even for the advanced stage. Honours will not be awarded unless a Candidate shows that he has made Physiology the subject of prolonged and careful study.

SUBJECT XV.—GENERAL BIOLOGY.

First Stage or Elementary Course.

For the Elementary Stage a knowledge of the following subjects only will be required, but the candidates will be expected to show a practical acquaintance with them.

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1. The general anatomy of a Frog, as an example of a vertebrate animal. The skeleton of the frog; its component parts, and their uses and relations to other organs. The structure and arrangement of the digestive, circulatory, respiratory, excretory, and nervous systems of the frog, and the uses and modes of action of their several parts.

2. The microscopical characters of the tissues of which the body of a vertebrate consists, and the ultimate formation of all parts of the body from nucleated cells.

The various kinds of epithelial cells; their distribution and uses. Connective tissue; cartilage; bone; nerve cells, and nerve fibres.

The microscopical structure of the kidney and of the spinal cord.

3. The characters of the blood-circulation as seen in the web of a frog's foot. Arteries, veins, capillaries. The blood corpuscles, red and white. The uses of the blood, and the modes and places in which these are effected.

4. Unicellular organisms. The form, size, and structure; the modes of growth and multiplication; and the conditions and results of the living activity of Saccharomyces, Protococcus, Amœba, and Paramecium. The resemblances and differences between these organisms and a white blood corpuscle and an epithelial cell.

5. The structure and mode of growth of Mucor and of Penicillium; the modes and processes of their reproduction; conidia, zygospores, ascospores; the germination of the spores and conidia; the physiology of these moulds, including the conditions and results of their living activity.

6. The structure and life history of a Fern.

(*a.*) *The Sporophyte.* The structure of the root, the stem, and the leaf; and the uses of their component parts. Apical growth of the root and stem; the growing point; the apical cell and the mode of its segmentation; the root cap. The asexual reproductive organs or sporangia; the spores.

(*b.*) *The Gametophyte.* The structure and development of the prothallium; the position and structure of the sexual organs, archegonium and antheridium; the sexual cells; ovum (oosphere); spermatozoid (antherozoid); the process and products of fertilisation; the early stages of development of the embryo sporophyte.

7. The structure and life history of a Bean or other Flowering Plant. The stem, the root, and the foliage leaf; and their principal modifications. The structure of the flower; the calyx, the corolla, the androecium, the gynœcium; the floral leaves, sepals, petals, stamens, and carpels; the symmetry of the flower. The structure of the anther; the pollen sacs and the pollen grains. The structure of the ovary; the ovule, and the embryo sac with its contents. The processes of pollination and fertilisation; the products of fertilisation; the fruit; the seed.

The physiology of the flowering plant. The physiology of nutrition in connexion with the presence of chlorophyll; the absorptive, assimilative, and transpiratory organs; conduction of liquid from the roots to the leaves; transpiration; the distribution of the organic substances formed in the leaves.

The resemblances and differences between Flowering Plants and Ferns.

8. The distinctive characters of animals and of plants, more especially in regard to their modes of nutrition.

Second Stage or Advanced Course.

For the Advanced Stage a knowledge of the following subjects will be required in addition to those included in the syllabus for the Elementary Stage. Candidates will be expected to show a practical acquaintance with the animals and specimens mentioned.

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1. The structure, mode of life and of reproduction of Amœba, Paramecium, and Vorticella. The general characters of Protozoa, and their relations to the higher animals or Metazoa, and to plants. The shell-forming Protozoa, and their influence in the formation of the earth's crust.

2. The Freshwater Polype (Hydra). The general structure and mode of life; the modes of reproduction. Ectoderm, endoderm, and mesoglœa. The microscopical characters of the cells of the ectoderm and endoderm, and their several uses.

3. The Earthworm (Lumbricus). The general structure of the earthworm; the division of the body into segments or somites. The mode of life of the earthworm; the action of earthworms in the formation of vegetable mould. The senses of earthworms.

4. The Freshwater Mussel (Anodonta). The general structure of the mussel, and its mode of life. The shell; its characters; its mode of formation and of growth. The structure, arrangement, and mode of action of the several organs; and especially of the circulatory, respiratory, and excretory systems.

5. The Crayfish (Astacus). The general structure of the crayfish, and its mode of life. The exoskeleton and its several parts; the mode of growth; the appendages. The structure, arrangement, and mode of action of the several organs; and especially the digestive, circulatory, respiratory, and nervous systems. The structure of the eye, and the uses of its several parts.

6. The Cockroach (Periplaneta). The general structure and mode of life of the cockroach. The external characters; the appendages, and especially the mouth parts. The structure, arrangement, and mode of action of the several organs, and especially the digestive, circulatory, and respiratory systems. The chief differences in structure and life history between a cockroach and a butterfly.

7. The Dogfish (Scyllium). The general structure and mode of life of a dog-fish. The external characters, the scales and teeth; the fins. The skeleton of the dog-fish. The structure, arrangement and mode of action of the several organs; and especially the digestive, circulatory, respiratory, excretory and nervous systems. The vertebrate eye and ear; their structure and the uses of their several parts. The main points of resemblance and of difference between a dog-fish and a frog.

8. The outlines of the development of the Frog. The formation of the eggs. Fertilisation and segmentation of the eggs. The development of the tadpole, and especially of the nervous system and alimentary canal. The changes that occur during the metamorphosis of the tadpole into the frog.

SUBJECT XVI.—ZOOLOGY.

First Stage or Elementary Course.

Questions will be confined to the following subjects, with which the candidate will be expected to show a practical acquaintance.

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1. The general characters of the Protozoa. The shells of Foraminifera and of Radiolaria. The structure and life history of the Infusoria.

2. The general characters of the Cœlenterata. The structure and life history of a Hydra, of a Jelly-fish, and of an Anemone.

3. The general characters of the Echinodermata. The structure and life history of a Starfish (Uraster) and of a Sea-Urchin (Echinus).

4. The structure of a Leech (Hirudo).

5. The general characters of the Annelida. The structure and mode of life of an Earthworm (Lumbricus).

6. The general characters of the Arthropoda and of their leading subdivisions. The structure and life history of a Crayfish (Astacus), a Cockroach (Periplaneta,) and a Butterfly.

7. The general characters of the Mollusca and of their leading sub-divisions. The structure and life history of a freshwater mussel (Anodonta), and a snail (Helix).

8. The structure and mode of life of Amphioxus.

9. The structure of a dogfish (Scyllium); more especially the skeleton, and the circulatory, respiratory, and nervous systems.

10. The structure and life history of a frog (Rana).

11. The structure and life history of a fowl or of a pigeon; more especially the skeleton.

12. The general characters of the Mammalia. The structure of a rabbit (Lepus); more especially the skeleton, and the digestive, circulatory, and nervous systems.

Second Stage or Advanced Course.

Questions may be set on the following subjects, in addition to those included in the syllabus for the elementary stage. Candidates will be expected to show a practical acquaintance with the animals and specimens mentioned.

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1. Porifera. The general characters of the group. The structure and life history of a calcareous sponge, and of the freshwater sponge (Spongilla).

2. Cœlenterata. The characters of the leading sub-divisions of the group. The structure and life history of a fixed hydroid polype, as Bougainvillea or Obelia, of a Medusa, and of a Coral. The structure, distribution, and mode of formation of coral reefs.

3. Echinodermata. The characters of the leading sub-divisions of the group. The structure and life history of an Ophiurid, a Holothurian, and a Crinoid (Antedon).

4. Platyelmia. The general characters of the Turbellaria. The structure and life history of a Fluke (Fasciola), and of a Tape-worm (Tænia).

5. Nemertinea. The structure of a Nemertine; and the chief modifications met with in the group.

6. Hirudinea. The structure of a Leech (Hirudo); and the chief modifications met with in the group.

7. Annelida. The characters of the leading sub-divisions of the group.

8. Rotifera. The structure and life history of a Rotifer.

9. Polyzoa. The structure and life history of a fresh-water Polyzoon. The leading modifications met with in the group.

10. Arthropoda. The characters of the leading sub-divisions of the group. The structure and life history of Cyclops, a Crab, a Scorpion, a Centipede, and Peripatus. The chief modifications presented by the eyes, and the excretory organs of Arthropoda.

11. Mollusca. The characters of the leading sub-divisions of the group. The structure and life history of an Oyster, a Limpet, and a Cuttlefish.

12. Pisces. The characters of the leading groups of Fish. The structure of a Cod or other Teleostean fish; more especially the skeleton, and the circulatory, respiratory, excretory and nervous systems.

13. Reptilia. The characters of the leading groups of Reptiles; and especially the skeleton and the circulatory system.

14. Mammalia. The characters of the leading sub-divisions of the group. The essential structure and the principal modifications in the skull and limbs of Mammalia as exemplified by the Dog, Pig, Sheep, Horse, Rabbit, Bat, and Man. The characters, mode of formation, and chief modifications of the teeth of Mammalia, both deciduous and permanent; especially in the types mentioned above.

15. The main facts in the development of Amphioxus, the Frog, the Chick, and the Rabbit; more especially the formation of the germinal layers, the development of the nervous, digestive, and circulatory systems, and the mode in which nutrition and respiration of the embryo is provided for.

16. The leading characters of the marine, freshwater, and terrestrial faunas. The main facts relating to the geographical distribution of vertebrates.

17. The mutual relations of the great groups of animals, both invertebrate and vertebrate; and the evidence on which these are determined.

Honours.

In this examination questions will be set at the discretion of the Examiner, who will have regard to the state of zoological teaching in the country and the means of acquiring information.

The examination will consist of a preliminary written paper, and, for those who qualify therein, of a practical examination at South Kensington at a subsequent date.

SUBJECT XVII.—BOTANY.

General Syllabus.

The enumeration of subjects is not intended to do more than guide the teacher. The examination will be especially directed towards ascertaining the amount and character of the practically acquired knowledge possessed by the students. The teaching should always be conducted, as far as possible, with reference to actual illustrative specimens rather than from text book descriptions.

General Morphology, Histology, and Physiology.

I. The differentiation of the plant-body into root, stem, and leaf.

i. The morphology of the root and its modifications; the branching of the root.

ii. The morphology of the stem and its modifications; the modes of branching of the stem; the structure and position of buds; vernation.

iii. The morphology of the leaf; the different kinds of leaves; the branching of the leaf; the different parts of the leaf; *leaf-base*, stipules, petiole, blade; their special modifications; the arrangement of leaves on the stem.

II. The structure of the organs and members, including—

i. The structure of the vegetable cell:

a. The structure and chemical and physical properties of the cell-wall.

b. The structure and chemical and physical properties of the cell-contents, including the protoplasm, nucleus, chlorophyll-corpuscles, cell-sap, starch-grains, raphides, &c.

ii. The distinctive characters and the mode of growth of the tissues.

III. The functions of the various organs; the relation of their structure to their functions.

i. The general processes of nutrition: assimilation; respiration.

ii. The chemical nature (1) of the food materials absorbed from the air and from the soil; (2) of the substances formed within the plant; starch, cellulose, sugars, fats, albuminoids; (3) of the principal ingredients of the ash of plants.

iii. The movements of fluids in the plant; transpiration; root-pressure.

iv. The irritability of plants, as manifested by growing and other motile organs.

v. The influence of light and heat on the various functions of plants.

Special Morphology and Physiology of the Angiospermous Flowering Plant.

The inflorescence and its modes of branching; bracts.

The difference between definite and indefinite inflorescences: the distinctive character of the following kinds; raceme, spike, spadix, corymb, panicle, umbel, head, cyme, glomerule.

The enveloping and essential organs of the flower: æstivation: the symmetry of the flower.

The modifications of the flower due to cohesion, adhesion, suppression, and multiplication of the various parts.

Morphological nature of the perianth, stamens and carpels.

The structure and use of the *stamen*; the filament, anther, pollen-sacs, pollen.

The structure of the carpel; the stigma; the style; the ovary; the placenta.

The structure and form of the ovule; the embryo-sac and its contents.

The processes of pollination and fertilisation.

The different forms of fruit: the distinctive characters of the following kinds; achene, nut, drupe, berry, pod, capsule.

The structure of the seed; presence or absence of albumen, structure and position of the embryo, nature of the aril.

The various modes of germination.

The different provisions for the persistence of the individual plant; annuals, biennials, perennials.

The description in technical language of fresh plants, taking the organs in the following order:

Root.	Corolla.
Stem.	Stamens.
Leaves.	Pistil.
Inflorescence.	Ovule.
Bracts.	Fruit.
Flower.	Seed.
Calyx.	Embryo.

The distinctive characters of the classes Dicotyledons and Monocotyledons, and of their principal divisions.

First Stage or Elementary Course.

In this stage strictly elementary questions only will be set on the subjects enumerated above. A knowledge will be required of the characters (including general properties) of the following natural orders, to be recognized upon fresh specimens:

Ranunculaceæ.	Boraginaceæ.
Cruciferæ.	Labiatæ.
Caryophyllaceæ.	Primulaceæ.
Leguminosæ.	Cupuliferæ.
Rosaceæ.	
Umbelliferæ.	Liliaceæ.
Compositæ.	Amaryllidaceæ.
Scrophulariaceæ.	

Second Stage or Advanced Course.

Candidates will be expected, in addition to a fuller knowledge of the foregoing subjects, to exhibit a practical acquaintance with the flora of the British Isles, including the characters of the orders and largest genera, their adaptations for cross-fertilisation, and their general geographical distribution.

They will also be expected to exhibit a practical acquaintance with:—

I. The morphology and physiology of Gymnosperms, as exemplified by Pinus.

II. The morphology and physiology of the Vascular Cryptogams, as exemplified by Selaginella and Aspidium.

III. The morphology and physiology of the Muscineæ, as exemplified by Polytrichum (or Funaria) and Marchantia.

IV. The morphology and physiology of the Algæ, as exemplified by—Fucus, Spirogyra, Protococcus.

V. The morphology and physiology of the Fungi (including *Lichens*) as exemplified by—

Agaricus.	Mucor.
Eurotium.	Saccharomyces.
Parmelia (or Collema).	

Honours.

Candidates will be expected to show a general knowledge, in addition to the foregoing, of the principal exotic orders, with their economic applications and geographical distribution.

They will be also expected to exhibit a general knowledge of the principal forms of the Gymnosperms, Vascular Cryptogams, Muscineæ, Algæ, and Fungi.

The Examination will consist of a preliminary written paper, and, for those who qualify therein, of a practical examination at South Kensington at a subsequent date.

SUBJECT XVIII.—PRINCIPLES OF MINING.*

This subject is naturally divisible into the two branches of Coal Mining and Metalliferous Mining, and the examination papers will be so constructed as to suit candidates who have studied, or have been practically engaged in, either branch.

The questions for examination will cover the matters included in the follows ing list.

Where the heading is susceptible of division the part relating to coal-mining is given under the sub-head A, and that special to metal mining under B; but where no such distinction is made the matter is to be considered as common to both branches.

1. Mineral Geology and Geography.
   Nature and position of useful minerals in the earth's crust.
   Beds, veins, and irregular deposits.
   Stream works and other alluvial deposits.

A.—Coal and other Stratified Minerals.

Composition and properties of coal, lignite, oil-shale, and other carbonaceous minerals.

Special geology of the carboniferous period, including details of the British coalfields and the more important foreign ones.

Geology of the liassic and oolitic iron ore formations.

Salt and gypsum deposits.

Slate and building stone strata of the United Kingdom.

Variations of character and continuity on stratified deposits, faults, heaves, slips, throws, troubles, and dislocations of all kinds. Rules of searching for faulted beds.

B.—Mineral Veins and Irregular Deposits.

Classification of mineral veins, and their relation to the containing rock or country.

Contact deposits. Relation and intersection of veins.

Direction of throw in faulted veins. Aggregate of small veins or stockworks. Strings, droppers, and cross courses. Horses, and other included masses.

Distribution of useful minerals in veins.

Composition, hardness, and density of the more abundant metallic minerals, and of the waste minerals or vein-filling.

Geographical distribution of minerals. Principal mineral districts of the United Kingdom and Colonies, Europe, and America.

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* *This syllabus is being recast; and will shortly be ready for issue.*

2. Exploration and Searching.—Appearances presented by the outcrop of coals and other stratified minerals. Relation of outcrop lines to slopes of valleys. Phenomena of backs of mineral veins. Gozzans of different lodes and their characteristic minerals. Shode and float stones. Prospecting and searching. Costeaning in new districts. Evidence afforded by surface indications of the value of old mines.

3. Breaking Ground.—Various forms of wedges, hammers, and picks. Use of explosives. Hand-boring gear. Weights and dimensions of borers, drills, and mallets. Forms of cutting edges. Sharpening and tempering drills. Machine borers, drills, and coal cutting machines in their principal modifications. Cleaning, loading, and firing bore-holes. Composition of explosives. Fuzes and detonators. Electric blasting. Safety regulations for blasting. Mechanical substitutes for blasting in fiery mines.

4. Deep boring for the discovery and working of Minerals.—Hand-boring tackle for shallow depths. Water-jet boring. Intermittent and continuous flushing of boring holes. Modifications of apparatus for deep holes. Free falling cutters. Rope-boring chisel and crown-boring heads. Brandt's hydraulic pressure borer. Diamond borer. Apparatus for testing perpendicularity of bore holes.

5. Details of opening ground.—Sinking, driving, and rising Forms and dimensions of shafts and levels for different purposes. Securing ground by timber, iron, steel, and walling and arching in brickwork and masonry. Methods of preserving timber underground. Tubbing in wood and iron for shafts in soft ground. Methods of boring and lining shafts through quicksands. Sinking by compressed air and freezing.

6. Methods of working Minerals.

A.—Mines on Stratified Deposits.

Pillar and stall and long wall working in their different modifications. Square work upon thick seams. Methods of working inclined thick seams with complete stowage of wastes. Working salt deposits by solution.

B.—Mines on Irregular Deposits.

Stoping overhand and underhand on lodes. Positions of winzes and passes or mills. Relative advantages of vertical and inclined shafts in entering on lodes. Methods of securing excavations on very large lodes.

7. Ventilation of Mines.—Composition of air and its associated gases. Gases given off in mine workings. Inflammable and explosive mixtures of air, fire-damp, and coal dust. Natural and artificial ventilation. Ventilation of narrow workings, levels, and drifts. Circulation of air through workings. Splitting, crossing, and regulating air currents. Stoppings, doors, and brattices. Upcast and downcast shafts. Construction of ventilating furnaces. Exhausting ventilators, rotatory, bell, and piston machines. Fans of various kinds. Compressing fans and blowers. Waterfall jet machines. Körting's aspirator. Efficiency of ventilating machines. Relation of pressure to velocity in air currents. Use of the barometer, thermometer, hygrometer pressure gauge and anemometer in measuring and controlling ventilation. Gas detecting and testing apparatus.

8. Lighting of Workings.—Candles and lamps. Construction of safety lamps in their different modifications. Limits of safety in currents of high velocity. Rules for the management of safety lamps. Fleuss apparatus for exploration in irrespirable gases.

9. Underground Conveyance. Construction and dimensions of tubs or trams. Underground railways and their maintenance. Hauling by men, horses, and machines. Underground engines. Compression and transmission

of air to machines underground. Various methods of rope and chain traction. Self-acting, balance, and engine inclined planes.
Underground locomotives and electric railways.

10. Drawing and Winding.—Kibbles and skips in vein mines and inclined shafts. Guides of wood, iron, and wire rope in vertical shafts. Various forms of cages. Construction of pit-head frames in wood and iron. Pit ropes, in hemp, fibre, iron, and steel. Weight, proof, and safety loads of flat and round ropes of different materials. Examination and lubrication of ropes. Methods of attaching ropes to cages. Safety catches and disconnecting hooks. Details of winding engines, geared and direct acting drums. Flat rope reels. Spiral drums, balance chains, and other methods of equalizing load on engine. Köpe's method of winding with tail rope to cages. Winding and speed indicators.

11. Drainage of Mines.—Adit levels. Methods of raising water by kibbles and tubs. Pumps and pit work. Lifting and plunger setts. Details of pump valves. Main rods of wood, iron, and steel. Safety catches and methods of counter-balancing. Pumping engines of different kinds. Water wheels, travelling rods, and bell cranks. Water pressure engines. Steam engines, direct acting and geared. Regulators of pumping engines. Cataracts. Davey's differential gear. Underground pumping engines. Combined steam and water pressure engines without rods. Pumping from distant dip workings. Pumps for acid mine water. Syphons and pulsometers. Construction of underground dams. Precautions required in driving towards drowned workings.

12. Travelling in Shafts and Levels.—Construction and arrangement of ladderways. Man engines of various kinds. Travelling in cages. Rules for ensuring safety in winding. Regulations for travelling in main waggon ways underground.

13. Surface Arrangements of Mines.—Methods of landing and discharging skips in vein mines. Banking and striking arrangements in collieries. Methods of unloading tubs. Screening, picking, and loading coal.

14. Dressing of Minerals.—Principles of separating minerals by sizing and subsidence in water. Handpicking and spalling. Mechanical picking tables. Rock breakers. Crushing rolls. Stamps. Dingey's and other pulverizers. Coal breakers. Disintegrators. Centrifugal grinding machines. Sizingsieves and drums. Hand and machine jigging processes for coal and minerals. Rittinger's and other current-sizing apparatus. Slime dressing machines. Round and rotatory buddles, frames, and vanners, percussion tables, blanket-strakes, labyrinth and other slime pits. Pneumatic methods of separating minerals. Special applications of magnetism to ore dressing. General succession of operations in ore and coal dressing.

15. Surveys and Plans of Mines.—Use of magnetic dial and theodolite underground. Reduction and plotting of observations. Scales and projections adopted for finished plans. Methods of determining magnetic variation.

The character of the different papers will, in a general way, be as follows:—

First Stage or Elementary Course.

This will treat principally of the simpler operations in actual mining, such as the use of tools (with details of form and dimensions) in driving, sinking, and getting minerals; the cutting and setting of timber; the construction of simple machines; the characters of beds and veins; and the composition and characters of the commoner useful minerals. The regulations for ensuring safety in dangerous operations, such as blasting and the removal of minerals and the management of lights in fiery mines, should be familiar to candidates; and they should have some knowledge of the mechanical principles

involved in the processes of ventilation, winding, pumping, and the dressing of minerals. Questions may be asked upon the general characters of the larger machines, but without requiring much detailed description.

Second Stage or Advanced Course.

Candidates in this stage should show some knowledge of details in their answers, and should be able to give proper sketches with dimensions when necessary in support of their written descriptions. They should be able to discuss the methods of occurrence and working of minerals in some district (of their own knowledge), and also be generally familiar with those of other districts from study. The constructive details of the machinery and engineering works of mines should also be studied in addition to the general principles. Exactness will be expected in all that relates to numbers, dimensions, and weights, and as neat and accurate drawing as the time will permit.

Examination for Honours.

This being intended for testing the results of advanced study, the questions will be of such a nature as to admit of considerable detail in answering. As a rule, candidates will be expected to show a knowledge of the structure and working details of some of the coal fields and metallic mining districts, of the United Kingdom and of the more important ones of foreign countries; to be able to discuss and illustrate the details of different classes of mining machinery such as those for pumping, winding, and ventilation; the laying out, working, and management of coal and metal mines with details of working staff and economic arrangement, and the details of dressing machinery and plant required for treating particular quantities of stuff.

The paper will practically be divided into three parts:—

1. Geological and structural,
2. Mechanical,
3. Mining proper,

and answers showing proficiency in any one or two of these will be of more value than a large number of vague or short answers in all three.

SUBJECT XIX.—METALLURGY, THEORETICAL.

The examination paper will be divided into four sections:—

1. Introductory Subjects and Fuel.
2. Iron and Steel.
3. Precious Metals.
4. Metals other than the foregoing.

For a pass in the advanced stage the student will only be expected to answer questions in TWO sections, of which Section 1 (Introductory Subjects and Fuel) must be one. In order to obtain a pass in the elementary stage or a FIRST class in the advanced stage the candidate must answer questions in at least THREE sections, of which Section 1 (Introductory Subjects and Fuel) must be one. The answering in one of these two selected sections need only be such as to show a general elementary knowledge of that section. The Elementary Stage is limited to the portions of the Syllabus enclosed with brackets thus [ ]. The remaining portion of the Syllabus, excluding the portions in small capitals, constitutes the advanced stage, but in this stage questions may also be set in the portions enclosed in brackets, more advanced knowledge will, however, be demanded than is expected from an Elementary Student.

In the elementary stage no questions will be set in connexion with the following metals:—Platinum, Cobalt, Nickel, Arsenic, Antimony, and Bismuth.

For honours the examination will deal with the entire syllabus, including the portions printed in small capitals, and candidates will be asked questions at the discretion of the Examiner, who will have regard to the present state of metallurgical science as carried on in this and other countries.

In the advanced stage and for honours unlabelled specimens will be placed before the candidate. All candidates should be able to make rough but trustworthy sectional drawings and sketches of furnaces and metallurgical appliances.

SECTION I.

Introductory Subjects and Fuel.

1. [Physical Properties of Metals.—Specific Gravity. Varieties of Fracture. Malleability. Ductility. Tenacity. Toughness. Softness. Elasticity. Lustre. Colour.] Influence of impurities on physical properties.

Classification of Metallurgical Processes.

[Explanation of the terms—Ore, "native" veinstuff, or gangue, "dressing." Reduction. Smelting. Regulus. Speise. Roasting. Distillation. Sublimation. Liquation. Scorification. Amalgamation. Cupellation.]

[Slags and Fluxes, general properties of.]—Atomic constitution of silicates. [External characters, and fusibility of slags.] The fusibility of certain compounds not containing silica; aluminates, &c. Melting Points of Silicates. Economic application of slags.

[Natural Refractory Materials employed in the Construction of Crucibles, Retorts, Furnaces, &c.] Distinction between acid and basic materials. Approximate composition. Mode of testing. [Crucibles.—Graphite, black-lead, or plumbago crucibles. Lining crucibles with carbon.]

[Classification of furnaces — the modes of producing and utilizing heat in the various forms. Principle of the Siemens and other analogous furnaces. Fire Bricks.]

2. [Classification of fuel.—The calorific power of fuel.] Method of determining the calorific intensity of fuel; Theoretical Computation. [Wood.—Elementary composition of dry wood. Peat or Turf.—Composition of peat.] Approximate composition of the ashes of peat. Desiccation of peat. Coal.—Approximate composition of the ashes of coal. Lignites. Approximate composition of lignites. [Bituminous coals. Caking coal. Free burning coal. Anthracite.] Frémy's chemical Researches on combustible Minerals. [Charcoal.—Various modes of charcoal burning. Charcoal burning in piles or stacks.] Yield of charcoal by volume and by weight. Theory of Charcoal burning. Peat charcoal. [Coke.—Properties of coke. Approximate composition of coke. General principles concerning the preparation of coke. Coking in circular piles, in long piles or ridges, and in large open rectangular kilns. Coke ovens. Cox's, Appolt's, and Coppée's coke ovens.] Composition and economic Application of the waste Products of Coke Ovens. Simon-Carve's Coke Oven. Coking of non-caking coal slack by admixture with pitch. Desulphurization of coke. Combustible Gases evolved during coking.

Comparison of Fuels in regard to Calorific Power. Evidence as to Value of a Coal afforded by Distillation in a closed Vessel. The various forms of Pyrometer.

SECTION II.

Iron and Steel.

3. [Physical] and Chemical [properties]. Preparation of pure iron by Electrolysis. [Welding. "Burnt Iron."] Oxides of Iron.—Action of Carbonic Oxide and Hydrogen on Oxides of Iron at varied Temperatures in presence of Carbonic Acid and Water. [Iron scale, or hammer slag.—Preservation of iron from rust. Sulphides of iron roasted with access of air.] Iron and Nitrogen. Passivity of Iron. [Iron and Phosphorus.] — On the action of Carbon on Iron containing Phosphorus. On the action of Iron at a high Temperature upon Phosphate of Lime in the presence of Carbon. Ditto in the presence of carbon and free silica. Manganese and Silicon. Iron and Silicon.—Reduc-

tion of silica by carbon in the presence of oxide of iron and other bases. Protoxide of iron and silica. [Reduction of silicate of protoxide of iron by carbon.] SILICATE OF SESQUIOXIDE OF IRON. TRIBASIC SILICATE OF PROTOXIDE OF IRON HEATED WITH ACCESS OF AIR. LIQUATION OF SILICATE OF PROTOXIDE OF IRON CONTAINING PHOSPHORUS.

[Iron and Carbon.—Modes of effecting the combination of carbon with iron. Cementation.] ACTION OF CARBONIC OXIDE UPON IRON. ACTION OF SOLID CARBON UPON IRON. IN AN ATMOSPHERE OF CARBONIC OXIDE. IN AN ATMOSPHERE OF HYDROGEN. [Amount of carbon in iron.] Maximum amount of carbon capable of being taken up by pure iron. IRON, MANGANESE, AND CARBON. Modes of existence of carbon in iron, grey, white, and mottled cast iron, steel. Chill-casting. Spiegeleisen, or specular cast iron. ACTION OF SILICON AND OF SULPHUR ON IRON CONTAINING CARBON. ABSTRACTION OF SILICON FROM CAST IRON BY FUSION WITH SESQUIOXIDE OF IRON ALONE, AND WITH THE ADDITION OF MANGANESE. ACTION OF DILUTE SULPHURIC OR HYDROCHLORIC ACID ON WHITE AND GREY CAST IRON. Influence of phosphorus, carbon, silicon, sulphur on iron.—["Red and cold, shortness."]

Alloys of Iron.—Process for zincing or galvanizing iron. STERRO-METAL. IRON AND TIN; TITANIUM; CHROMIUM; TUNGSTEN.

[Ores of Iron.—Classification and metallurgical value of:—Physical properties and chemical composition of.]

ASSAYING OF IRON ORES BY DRY AND WET METHODS.

[Direct Extraction of Iron in the Malleable State from the Ore.—Primitive appliances. Catalan Process; trompe, or blowing machine.] Its advantages and disadvantages. Theory of the process. CONDITIONS AFFECTING THE QUALITY OF THE IRON PRODUCED. Characters of the iron produced. Stückhofen or High Bloomery Furnace. CLAY'S PROCESS. CHENOT'S PROCESS. SIEMENS' PROCESS AND BLAIR'S PROCESS. [Indirect Extraction of Iron in the State of Cast Iron from the Ore.—Description of the modern blast furnace; foundation, hearth, twyer openings, twyers, tunnel head, bracing, blast main, and blast pipes.] BLAST ENGINES. CHEMICAL PHENOMENA OF THE MODERN BLAST FURNACE. [Hot Blast.]—Neilson's patent. [Apparatus for heating the blast. Syphon pipe.] GAS OVEN. Cowper's and Whitwell's stoves. THEORY OF THE HOT BLAST. Saving of fuel. WATER-TWYERS. [The Gases of Iron-smelting Blast Furnaces.]—Composition of the gases of the Furnace. PRODUCTION OF CYANOGEN IN THE BLAST FURNACE [Utilization of the gases escaping from blast furnaces. "The waste gas." Modes of taking off the gases with open-mouthed and with closed mouthed furnaces.] The best form of the blast furnace. RATIOS OF HEIGHT TO DIAMETER. Decrease in volume which the materials undergo during their descent. RECTANGULAR OR RACHETTE FURNACE. BLOWING IN A BLAST FURNACE. [Tapping.] Derangements in the working, scaffolding, and slips. Loss of iron in the slag. INDICATIONS AFFORDED BY COLOUR OF SLAGS. ACCIDENTAL PRODUCTS OF BLAST FURNACES. CYANONITRIDE OF TITANIUM. GRAPHITE OR KISH. Reduction of phosphoric acid in the blast furnace, and passage of the phosphorus into the pig iron. SUBSTITUTION OF LIME FOR LIMESTONE AS A FLUX. Yields of blast furnaces.

[Various kinds of Pig Iron.]

[Production of Malleable Iron from Cast Iron.]—South Welsh process; the hollow fire. Swedish Lancashire Hearth; WALLOON PROCESS, AS CONDUCTED IN SWEDEN. [Slags or cinders produced in finery processes. Running out fire or refinery; composition of refined iron; ditto refinery slags or cinders. Puddling; pig boiling and dry puddling furnace. Invention of iron bottoms; manipulation;] theory of the process; [composition of tap cinder;] MECHANICAL PUDDLING. APPLICATION OF WASTE BLAST FURNACE GAS TO PUDDLING. SIEMENS' GAS PUDDLING FURNACE; PRINCIPLE OF THE FURNACE. THE GAS PRODUCERS. [Working of the Ball.—Forge hammers; tilt hammers. Helves or lift hammers.] STEAM FORGE HAMMERS. [Squeezers; Puddling or puddle rolls.] COMPOSITION OF PUDDLED BARS. [Working of the Puddled Bar into Merchant or Finished Iron.—Reheating furnace; with coal as fuel.] With gaseous fuel, or gas-welding furnace.

[Piling.] YIELD OF PUDDLED AND FINISHED IRON. Manufacture of rails. COMPOSITION OF THE CINDER FROM THE REHEATING FURNACE.

[Varieties of Sheet Iron and Slit Rods.—Tin plates. Charcoal plates.] COKE PLATES. BELGIAN SHEETS. RUSSIAN SHEETS. SWEDISH IRON. DANNEMORA IRON. ARMOUR PLATES; ROLLED; HAMMERED.

[Classification of processes for production of Steel.—Carburization of bar iron. Converting furnace.] CARBURIZATION BY GASEOUS COMPOUNDS OF CARBON. [Carburization by fusing compact iron with carbonaceous matter;] WOOTZ. Siemen's-Martin process. IMMERSION OF MALLEABLE IRON IN MOLTEN CAST IRON. Theories of the carburization of iron.—[Bessemer process. Description of the apparatus.] Basic and acid linings how prepared, reactions in the process, how adapted for iron containing much phosphorus. PREPARATION AND USE OF SPIEGELEISEN AND FERRO-MANGANESE. [Casting of Steel.—Furnaces and crucibles. Fusion of steel in the reverberatory furnace.] THE ADDITION OF MANGANESE IN THE CASTING OF STEEL. Manipulation of Steel.—THEORY OF HARDENING AND TEMPERING STEEL. Welding steel. Shear steel. ESTIMATION OF PHOSPHORUS, SULPHUR, CARBON, AND SILICON IN IRON AND STEEL.

SECTION III.—THE PRECIOUS METALS.

GOLD.

4. [Physical] and CHEMICAL [properties]. Impurities in gold; lead, arsenic, antimony. ACTION OF CHLORINE ON TERSULPHIDE OF GOLD. [Gold and chlorine.] Action of oxalic acid, and of sulphate of protoxide of iron on solutions of chloride of gold.

[Alloys of gold.]—

USE OF THE TOUCHSTONE. DEFINITION OF THE TERMS "STANDARD" AND "CARAT."

Ores of Gold.—VARIOUS METALLIFEROUS MINERALS CONTAINING GOLD.

ASSAYING OF ORES AND ALLOYS OF GOLD BY DRY AND WET METHODS.

[Classification of methods of Extraction.—Amalgamation of quartz containing gold; apparatus employed, mode of working, nature of the products, and method of extracting the gold from the amalgam.] PLATTNER'S PROCESS BY CHLORINE. BRUCKNER'S CALCINER. PAN AMALGAMATION. "SWEEP" REFINING. Electro-deposition.

Classification of wet and dry methods for the separation of Gold from Silver and Copper. Methods of working, chemical reactions.—Apparatus. ["Parting." Miller's process for refining gold containing silver, by chlorine.] Electro "parting" and Electro-plating.

SILVER.

5. [Physical] and CHEMICAL [properties]. [Action of heat, of heat and air, and of acids upon silver. Silver and Oxygen.] [Sulphide; physical and chemical properties cf. Modes of formation. Action of heat. Action of heat and air.] Action of heat and air in the presence of other metallic sulphides. ACTION OF HYDROGEN OF STEAM, of acids, of nitre, of iron, of lead, OF COPPER, AND OF MERCURY UPON SULPHIDE OF SILVER. [Combination with other sulphides.] "OXIDIZED SILVER" PROCESS. [Sulphate; physical and chemical properties. Mode of producing. Action of heat. Action of chloride of sodium.] SOLUBILITY IN WATER. Action of hyposulphite of soda on chloride of silver. [Nitrate; physical and chemical properties. Action of heat. Method of separation from nitrate of protoxide of copper. Silver and Chlorine. Chloride; physical and chemical properties. Methods of formation by dry and wet processes. Methods of reduction by carbonate of soda and by zinc. ACTION OF HYDROGEN, [of acids, of chloride of sodium,] OF CYANIDE OF POTASSIUM, COPPER, MERCURY, [of sulphur, of metallic sulphides, and of protoxide of lead upon chloride of silver].

[Alloys of Silver.]—Levol's Alloy, Liquation of Alloys.

[Ores of Silver.]—Nature of metalliferous Minerals containing Silver.

Assaying of Ores and Alloys of Silver by the dry and wet Methods.

[General classification of methods of Extraction, wet and dry.—Extraction of silver from argentiferous copper: Liquation process, or description of furnace. Mode of operation. Nature of the products. Extraction of silver from the ore: Mexican amalgamation process.—Apparatus employed, materials used, method of working, nature of the products.] Chemical Principles involved. Specialities of the Process. [Working of the silver amalgam.] Application of Copper Amalgam. Loss of Silver in the Process. Cazo Process. Freiberg amalgamation process.—Description of furnaces and apparatus. Stetefeldt Calciner. Mode of working and chemical Principles involved. Composition of Silver Amalgam. Amalgamation of argentiferous Speise. Amalgamation of argentiferous Copper Regulus. [Extraction of silver from argentiferous regulus: Ziervogel's process.—Description of the furnaces and apparatus employed, and chemical reactions involved in the various operations.] Specialities of the Process. [Augustin's process.—Description of the process and chemical principles involved.] Von Patera's Method.—Apparatus used, Materials employed, Products obtained, and chemical Reactions in the Process. [Extraction of silver from ore by means of lead]: Furnaces used, method of working, nature of the products. Chemical Composition of the Products and chemical Reactions involved. Electro-plating.

Platinum.

6. Physical and chemical properties of the metal.

Ores of Platinum.—Native platinum. Physical characters. Metals occurring in. Minerals associated with.

Methods of Extraction.—Wet method. Deville's method. Melting of platinum. Working of Platinum. Electro-plating.

SECTION IV.—METALS OTHER THAN THE FOREGOING.

Copper.

7. [Physical] and chemical [properties]. Impurities in copper. [Dioxide; protoxide. Disulphide. Disulphide of copper heated with access of air. Disulphide of copper heated in admixture with dioxide, protoxide, or sulphate of copper. Dioxide of copper heated with protosulphide of iron and silica. Disulphide of copper heated with carbon, and iron. Copper and dioxide of copper. Copper and carbon. Overpoled copper.] Copper and nitrogen. Copper and phosphorus. Influence of various Foreign Matters on Electric Conductivity.

[Ores of Copper.—Characters and chemical composition of.]

Assaying of Copper Ores by dry and wet Methods.

[Copper Smelting.—The Welsh Process.—Furnaces employed. The reactions which occur in the process. Calcination;] Composition of the gaseous Products which escape from the Ore-Calciner. Utilization of sulphurous acid. Gerstenhoffer's Calciner. [Melting of the calcined ore; external characters, and composition of coarse metal and ore-furnace slag. Calcination of the granulated coarse metal; Melting of calcined granulated coarse metal; white metal, blue metal, metal-slag. Moss-copper. Roasting; blister-copper, roaster-slag.] "Best selected" process. [Refining.] Elimination of the following Foreign Metals during the Welsh Process of Copper Smelting.—Arsenic, Antimony, Tin, Nickel, Cobalt, Gold, and Silver. Muffle Furnaces. Copper smelting in

Blast Furnaces: In Sweden.—Furnaces employed; ore-furnace, black copper furnace, refining hearth. Loss in smelting. SMELTING OF COPPER SCHIST IN PRUSSIAN SAXONY. COPPER SMELTING IN PERM IN RUSSIA. CUPRIFEROUS PIG IRON. THEORY OF THE PROCESS. KERNEL-ROASTING AT AGORDO.—COMPOSITION OF THE ORE. THEORY OF THE PROCESS. Wet methods of extracting copper. Electro-deposition and purification of copper.

ZINC OR SPELTER.

8. [Physical] and CHEMICAL [properties]. Impurities in commercial zinc. ACTION OF CARBONIC ACID AND CARBONIC OXIDE ON METALLIC ZINC AND OXIDE OF ZINC. [Reduction of oxide of zinc by carbon, carbonic oxide, and hydrogen.] SILICATES OF ZINC. REDUCTION OF SILICATE OF ZINC BY CARBON. [Sulphide of zinc heated with access of air,] with oxide of zinc, and WITH CARBON.

[Ores of Zinc.—Physical character and chemical composition of.]

METHODS OF ASSAYING ORES OF ZINC.

[Methods of Extracting Zinc.—English Process.—Roasting or calcination of the blende.] TREATMENT OF THE ROUGH ZINC. [Silesian Process.—Retorts and appendages. Description of the furnace.] Calciner. Distillation of zinc. [Melting of distilled zinc. Belgian Process.—Retorts and appendages. Description of the furnace.] ZINC FUME. PROPOSED IMPROVEMENTS IN THE EXTRACTION OF ZINC. Electro-deposition and purification of zinc.

[Brass.—Physical properties of various alloys of copper and zinc.] Direct preparation of brass. [Muntz's metal.] Defects occurring in brass.

LEAD.

9. [Physical] and CHEMICAL [properties]. [Action of heat. Autogenous soldering. Action of air, of water], OF CARBONIC ACID, OF DIOXIDE OF COPPER, AND OF ACIDS UPON LEAD. [Protoxide; mode of formation by dry] and WET [methods]. [Action of carbon,] OF HYDROGEN, AND OF CARBONIC OXIDE. [Fusibility with metallic oxides.] ACTION OF METALS WHEN HEATED WITH PROTOXIDE OF LEAD. [Red lead. Action of heat and air upon sulphide of lead.] ACTION OF PROTOXIDE OF LEAD ON PEROXIDE OF IRON AND CARBON, and of [iron, when heated with sulphide of lead]. [Action of metallic lead on sulphide of silver. Combination of sulphide of lead with other sulphides. Sulphate.—Action of carbon, of iron, of lead, of protoxide of lead, and of sulphide of lead, on sulphate of lead.]

[Alloys of Lead.—Lead and antimony; arsenic; zinc;] COPPER; MERCURY; GOLD; [silver].

[Ores of Lead.—Physical character and chemical composition of.]

METHODS OF ASSAYING LEAD ORES.

[Extraction of Silver from Lead.—Pattinson's process.]—THEORY OF THE PROCESS, [methods of working, description of the apparatus] and mechanical appliances. LIMIT OF CONCENTRATION. EFFECT OF FOREIGN METALS. [Parkes' process.]—Methods of working. PRINCIPLES INVOLVED. [English process of cupellation.—Construction of furnace, mode of conducting the process, nature of the products], CHEMICAL COMPOSITION OF THE PRODUCTS AND CHEMICAL REACTIONS INVOLVED. German process of cupellation.—Description of furnace, mode of conducting the process, nature of the products and CHEMICAL COMPOSITION OF PRODUCTS. Refining of "Blicksilber."—In open test. Under a muffle. Desilverisation of lead by electrolysis.

[Extraction of Lead from the Ore.—Classification of processes and general chemical reactions. Flintshire furnace.—Description of the furnace, nature of the products.] ACTION OF LIME. Brittany furnace.—process. Spanish reverberatory furnace.—Description of and mode of working. [Cornish process.—Description of "calciner" and of "flowing furnace" process. Nature of the products.] CHEMICAL COMPOSITION OF THE PRODUCTS. ACTION OF IRON. [Ore hearth.—Construction of the furnace, method of working, and nature of the products.] AMERICAN ORE HEARTH. PECU-

LIARITY. ADVANTAGES. Roasting and deoxidizing process: Swedish process.—Nature of the ores, description of the furnace, mode of working, and nature of the products. Freiberg process.—Description of the furnaces, method of working, and nature of the products. ACCESSORY PRODUCTS. COMPOSITION OF THE PRODUCTS. Pontgibaud process.—Description of the ore, roasting and blast furnaces, mode of working, and nature of the products. CHEMICAL REACTIONS INVOLVED. German method with basic silicate of protoxide of iron.—Description of the Rachette furnace. Electro-deposition and purification of lead.

Condensation of Lead Fumes.—Description of the various methods and apparatus employed. Physical characters AND CHEMICAL COMPOSITION lead fume. Treatment of lead fume.

[Softening of Hard Lead.—Principle. Liquation of hard lead.]

[Reduction of Litharge.—]

[Manufacture of Red Lead.—]

Miscellaneous Details.—Varieties of lead in commerce. METHODS OF TESTING FOR METALS PRESENT IN LEAD. CAST SHEET LEAD. Lead suitable for pipes, sulphuric acid chambers, red lead and whitelead. POISONING BY LEAD.—SYMPTOMS OF POISONING. PREVENTIVE MEASURES.

TIN.

10. [Physical] and CHEMICAL [properties of the metal]. [Action of heat, of air, of heat and air], and OF ACIDS [upon the metal]. ACTION OF TIN ON VARIOUS METALLIC OXIDES.

[Alloys of Tin.—]

[Ores of Tin.—"Stream tin." "Mine tin." "Wood tin."] MINERALS OCCURRING WITH TIN ORES.

ASSAYING OF TIN ORES.

[Smelting of Tin Ores.—In reverberatory] and blast [furnaces].—[Description of furnaces used, methods of working, nature of the products,] CHEMICAL COMPOSITION OF THE PRODUCTS, AND CHEMICAL REACTIONS INVOLVED. [Refining of tin.] OXLAND'S PROCESS.

[Commercial Varieties of Tin.—Common tin. Refined tin. Grain tin. Block tin.] FOREIGN METALS OCCURRING IN TIN. METHODS OF TESTING FOR FOREIGN METALS. Electro-deposition. Electro-plating.

MERCURY.

11. [Physical] and CHEMICAL [properties]. [Action of heat, of air,] OF ACIDS, AND OF CHLORINE [upon Mercury].

[Protosulphide or vermilion]; methods of preparation, [physical] and CHEMICAL [properties. Action of heat, of heat and air,] OF HYDROGEN, [of iron, of lime,] OF ALKALIES, OF CHLORINE, AND OF ACIDS UPON PROTOSULPHIDE.

[Amalgams.—Mercury and silver; gold; copper]; IRON; sodium.

[Ores of Mercury.]—NATURE OF MINERALS CONTAINING MERCURY, METHODS OF ASSAYING OF ORES OF MERCURY.

[Methods of Extraction.—Description of furnace, method of operation, nature of the products,] and CHEMICAL REACTIONS INVOLVED in the following methods: HUANACAVELICA PROCESS. ALMADEN PROCESS. IDRIAN PROCESS. Alberti process. Hähner's furnace process. GALLERY FURNACE PROCESS. FAHLORE PROCESS.

IMPURITIES PRESENT IN MERCURY. METHODS OF TESTING MERCURY FOR FOREIGN METALS. Modes of purifying commercial varieties of mercury.

COBALT.

12. Physical and CHEMICAL properties of the metal. METHODS OF PREPARATION. Protoxide; mode of formation, physical and CHEMICAL properties. ACTION OF HYDROGEN. Physical and CHEMICAL properties and mode of producing the compounds of cobalt and arsenic,

Ores of Cobalt.—Nature of Minerals containing Cobalt.
Methods of estimating Cobalt.
Cobalt products.—Smalts; mode of preparation. Apparatus used. Nature of the products. Chemical Composition of the Products. Chemical Principles involved in the manufacture. Uses of smalts and oxide of cobalt. Silicate of protoxide of cobalt; mode of obtaining. Printers' blue.
Alloys of Cobalt.

Nickel.

13. Physical and chemical properties of the metal. Physical and chemical properties and mode of obtaining compounds of nickel and sulphur. Physical and chemical properties of the compounds of nickel and arsenic. Nickel speise; chemical Composition. Action of Heat and Air upon Arsenide of Iron, Cobalt, and Nickel. Nickel and carbon.
Alloys of Nickel.—German silver; mode of preparation, physical characters and composition of the commercial varieties.
Ores of Nickel.—Physical characters and chemical Composition of: Nature of other Minerals containing Nickel. Meteoric Iron.
Methods of assaying Nickel Ores.
Methods of Extraction.—Apparatus employed, mode of working, nature of the products, and chemical Reactions involved.
Commercial varieties of nickel. Foreign Metals occurring in Nickel. Electro-deposition. Electro-plating.

Arsenic.

14. Physical and chemical properties. Action of heat, and of heat and air upon the metal. Physical and chemical properties, and methods of preparation of the compounds of arsenic and oxygen. Action of carbon, of Hydrogen, and of Carbonic Oxide upon Arsenious Acid. Physical and chemical properties, and methods of obtaining the compounds of arsenic and sulphur.
Ores of Arsenic.—Nature of Minerals containing Arsenic.
Methods of estimating Arsenic.
Methods used for obtaining White Arsenic.—Description of apparatus, methods of working, nature of the products and chemical Reactions involved. Methods of refining white arsenic; description of apparatus, mode of working, and nature of products. Preparation of metallic arsenic.
Applications of arsenic and its various compounds.

Antimony.

15. Physical and chemical properties of the metal. Tersulphide; methods of formation. Physical and chemical properties. Action of heat, or of heat and air, of Steam, of carbon, of nitre, and of iron upon the sulphide of antimony.
Alloys of Antimony.—Antimony and lead. Composition of type metal and stereotype metal. "Regulus of Venus." Hardening effect of antimony on alloys.
Ores of Antimony.—Physical characters and chemical Composition of: Nature of Minerals containing Antimony.
Assaying of Ores of Antimony.
Methods of Extraction.—Apparatus used, methods of working, nature of the products. Chemical Composition of the Products, and chemical Reactions involved in the following methods:—Liquation process. Reduction by iron, English process. French method.
Foreign Metals occurring in Antimony. Methods of testing for Foreign Metals.

Bismuth.

16. Physical and CHEMICAL properties. Tersulphide; methods of formation. Physical and CHEMICAL properties. Action of heat. ACTION OF METALS WHEN HEATED WITH TERSULPHIDE OF BISMUTH.

Alloys of Bismuth.—

Ores of Bismuth.—Names of various minerals containing bismuth.

METHODS OF ESTIMATING BISMUTH.

Methods of Extraction.—Apparatus used. Description of processes, AND CHEMICAL ACTIONS INVOLVED IN THE VARIOUS METHODS.

FOREIGN METALS OCCURRING IN BISMUTH. METHODS OF TESTING FOR FOREIGN METALS.

SUBJECT XIX. *p.*—METALLURGY, PRACTICAL.

FIRST STAGE OR ELEMENTARY COURSE, AND SECOND STAGE OR ADVANCED COURSE.

In the elementary stage a practical examination will test the candidate's knowledge of:—

(*a.*) The principles on which "calcination," "roasting," and "reduction" are based.

(*b.*) The testing of fire-resisting materials.

(*c.*) The preparation of common alloys, such as pewter, brass, and bronze, and:—

(*d.*) Subjects dealt with in those portions of the Syllabus enclosed in brackets, thus [ ].

In the advanced stage the candidate will be required to conduct at least two of the operations enumerated in this syllabus on materials which will be supplied to him.

FUEL.—[Evidence as to the value of a coal afforded by distillation in a closed vessel.] Determination of the amount of ash and sulphur in fuel.

Determination of the calorific power of coal with the aid of Thompson's calorimeter.

REFRACTORY OR FIRE-RESISTING MATERIALS.—The student should prepare for himself small clay crucibles from a material consisting of two parts, by measure, of unburnt to one part of burnt Stourbridge clay, some of these crucibles being lined with a mixture of charcoal powder and treacle. Cupels of bone ash must also be prepared.

[Testing of fire-clay and crucibles with a view to ascertain, 1st, their capability of sustaining a high temperature; and, 2nd, their power of resisting the corrosive action of fused metallic oxides.]

GENERAL PROPERTIES OF FLUXES.—The fusibility and external characteristics of various silicates.

METHODS ADOPTED IN THE EXTRACTION OF METALS FROM THEIR ORES.

ROASTING: [conversion of metallic sulphides into oxides and sulphates by roasting in the muffle furnace, especially sulphides of copper, lead, silver, and zinc.] Experimental solution of problems involved in roasting complex mixtures of metallic sulphides.

Estimation of the amount of compounds soluble in water produced by roasting certain mixtures of metallic sulphides.

REDUCTION.—[The reduction of oxide of iron will be best taught in this stage by the heating of hæmatite in the small clay crucibles or in crucibles lined with charcoal, suitable fluxes and reducing agents being added. The

student must be taught to recognise, from the fracture of the button, the variety of iron produced.]

[Reduction of sulphide of lead], [(1) by the mutual action of the sulphide on the oxide;] and (2) by the action of sulphide and sulphate.

[Reduction of copper from sulphide by the action of the sulphide on the oxide of copper. In these cases the mixture is so adjusted that the relation between the sulphur and oxygen shall be the same as in sulphurous anhydride.]

[Reduction of the sulphide of lead] and of sulphide of antimony [by metallic iron].

[Cementation (oxidizing and carburizing).—The leading effects that attend, (1) the prolonged heating of thin pieces of cast iron in hæmatite; and (2) the prolonged heating of wrought iron in charcoal.]

The production of steel may also be studied by fusing wrought and cast iron together in suitable proportions.

Amalgamation.—Action of metallic mercury when triturated with metallic silver, artificially prepared sulphide of silver, and chloride of silver: separation of each amalgam so formed; its concentration by squeezing in leather, and subsequent distillation.

Liquation.—Separation of the native sulphide of antimony from its gangue.

Separation of argentiferous lead from an alloy of 50 per cent. lead and 50 per cent. copper, by heating a disc of the alloy somewhat above the melting point of lead, so that the more fusible metal can flow away, leaving an impure sponge of copper behind.

[Cupellation.—The general features of the enrichment of argentiferous lead by scorification in a muffle with subsequent separation of the silver by cupellation on a bone ash cupel.]

Determination of the amounts of lead required to effect the removal by cupellation of small and varying amounts of copper alloyed with silver.

Chlorination.—Formation of chloride of gold by the action o chlorine gas on finely divided gold. Solution of the chloride in water, and the precipitation of the gold by ferrous sulphate. Preparation of chloride and of sulphate of silver. Solution of the chloride of silver in brine, and separation of the metal from solution by metallic copper. Separation of the silver from the sulphate by the action of metallic copper.

Treatment of copper pyrites by roasting with common salt, and subsequent extraction of the soluble chloride of copper by water.

Treatment of pyrites mixed with sulphide of silver by roasting with common salt, and estimation of the amount of silver that has been converted into chloride as shown by the solvent action of hyposulphite of sodium.

Treatment of auriferous iron pyrites by roasting with salt; conversion of the compound so formed into finely divided gold by an elevation of temperature, and subsequent conversion of the gold into chloride soluble in water, by the action of chlorine gas. Recovery of the gold from solution by precipitation with ferrous sulphate.

Purification of Metals.

Wet Methods.—Separation of copper alloyed with silver and gold by "parting" with sulphuric acid, recovery of the silver from solution by metallic copper, and of the copper from the sulphate of copper so formed by metallic iron. [This will be useful to the student as showing the replacement of a metal in solution by a cheaper one.]

Separation of gold from silver by "parting" with nitric acid; recovery of the silver by precipitation as chloride, and its subsequent reduction to the metallic state by zinc or iron.

Dry Methods.—[Refining copper by oxidizing and "poling" commercial copper melted in a crucible. The student should make himself familiar with the characteristics of the ingot of metal in the three states known as:—1, "dry copper"; 2, "tough copper"; 3, "overpoled."]

Alloys.

[It will be well, in the first instance, to cause the student to prepare alloys of which the chemical, physical, or mechanical properties differ widely from those of their constituent metals, and to direct them to ascertain, so far as the facilities of the laboratory will permit, that the alloys so prepared correspond with the descriptions usually given of them. Such alloys would be (1) of the copper-zinc series, one or more kinds of brass; (2) of the copper-tin alloys, speculum metal and gun metal; (3) of the tin-lead (with or without other metals, fusible metal). They should also prepare the "regulus of Venus" (copper and antimony in equal parts by weight), and they should be shown that an alloy of equal parts by weight of lead and zinc will separate into two nearly distinct layers when slowly cooled from fusion, and that tin with a small per-centage of arsenic resembles zinc.]

Honours.

For honours the candidate will be required to take up an analysis or a metallurgical operation already in progress and complete it.

In addition to the subjects indicated in the advanced stage, the student must be able to make a complete analysis of cast iron or steel, estimating the total carbon by combustion and the combined carbon by Eggertz method. The sulphur and phosphorus may be determined by any of the well-known methods, but the student should be familiar with the respective advantages of the different methods in use.

The reduction of metallic oxides by carbon and by carbonic oxide should be carefully studied, as well as the action of carbonic oxide on precipitated ferrous oxide at varied temperatures from 150° C., and the inverse action of carbonic anhydride on metallic iron at a red heat.

In addition to the "wet methods" before mentioned, the various "wet methods" for separating nickel and cobalt should be taught.

The student must also be able to prepare chemically pure gold and silver.

Note.—No candidate who does not pass the practical as well as the theoretical examination can obtain a medal or full certificate in Honours. *See* Science, sec. 31, page 36.

Laboratory for Practical Metallurgy.

In most cases comparatively small additions to the Chemical Laboratories, arranged and furnished in accordance with the prescribed regulations (*see* page 192), will enable Practical Metallurgy to be taught.

It is necessary that a wind furnace should be provided and this furnace should be in connexion with a flue at least 30 feet high. The furnace may be placed in a basement below the laboratory, but there is no objection, if space permits, to its being in the laboratory.

There must also be a muffle furnace capable of heating to bright redness a muffle at least 8 inches long, 4 inches wide, and 3 inches high; when there is an abundant supply of gas, gas muffle furnaces, such as are supplied by Fletcher of Warrington, or Griffin of London, may be adopted with advantage.

No more than three candidates will be allowed to use the same muffle furnace at any examination in Practical Metallurgy.

The muffle furnace may be in the laboratory, as it is also useful in conducting various chemical operations.

Each student should be provided with the tools and appliances set forth in List I., and those named in List II. must be kept in the laboratory for the use of the students.

List III. gives the reagents, fluxes, &c. that will be required by the students for general use.

No student should be allowed to enter for the practical course in Metallurgy who has not already passed in the Elementary Stage of Subject X. (Inorganic Chemistry, Theoretical).

List I.

Each student in the Advanced Stage and Honours must be provided with the following articles. In the Elementary Stage the student need only have the articles that are marked with an asterisk :—

*1 small hammer.
1 small anvil.
1 drill.
*1 steel spatula.
*1 camel hair brush.
*1 hard tooth brush.
2 sheets of glazed paper.
*1 pair of scissors.
1 pair of pliers—half round, taper.
1 pair brass forceps.
*1 triangular file.
*1 wire triangle—covered.
2 glass rods.
1 glass funnel, 3 inches diameter.
4 beakers, Nos. 5, 6, 7, and 8.
1 washing bottle, fitted.
2 conical flasks and small funnels.
1 Bohemian flask, 24 oz.
1 Berlin evaporating dish, No. 7,
1 do. No. 2, 3½ inches diameter.
*1 porcelain mortar.
*1 porcelain crucible, 1½ inch diameter.
1 packet of filters, 5½ inches diameter or filtering paper.
6 test tubes.
2 feet combustion tubing.
1 lens.
*6 scorifiers, 2½ inches diameter.
*12 cupels.
*6 earthen crucibles, each size, 1¾, 2½, and 3 inches diameter.
*1 black lead crucible, 3 inches diameter.
*2 roasting dishes, 3 inches diameter.
*1 duster or cloth.
*1 note book.
½ oz. silver, or old or foreign silver coin.
2 dwts. gold, or old or foreign gold coin.

List II.

The following must be kept for general use :—

3 pairs of furnace tongs.
1 open ingot mould.
1 ingot mould with hemispherical cavities.
1 copper scoop.
1 cupel mould.
1 mould for making small clay crucibles.

List III.

The following metals and reagents, which need not be of a high degree of purity, must be kept in addition to the ordinary stock of a Chemical Laboratory.

Antimony.
Arsenic.
Bismuth.
Copper.
Iron.
Lead (in thin sheet free from silver)
Mercury.
Tin.
Zinc.
Charcoal.
Sulphur.
Antimony Sulphide (black).
Bismuth Oxide.
Copper Oxide (black).
Copper Sulphate.
Cobalt Oxide.
Iron Oxide.
Lead Oxide.
Lead Sulphate.
Manganese Oxide (black).
Mercury Sulphide (red).
Nickel Oxide.
Tin Oxide.
Zinc Oxide.
China Clay.
Glass Powdered.
Lime.
Salt.
Clay.

SUBJECT XX.—NAVIGATION.

First Stage or Elementary Course.

General Notions and Definitions.—Figure of the earth; diameters of the earth; axis, poles. Equator or equinoctial line; meridians; first meridians; parallels of latitude. Latitude; longitude: difference of latitude; difference of longitude. Rhumb line; course; nautical distance; meridian distance; departure.

Examples of differences of latitude and differences of longitude to prove that the meridian distance is equal to the difference of longitude multipled by cosine of latitude. Examples; having given any two of these to find the third.

The Compass.—Description; Points. Number of degrees, minutes, and seconds in a point, ¼ point, ½ point, ¾ point. To reduce points and parts of points into degrees, minutes, and seconds, and conversely.

Variation of the Compass: easterly, westerly. How to be allowed (1), when it is required to find the true from compass course; (2), to find compass course from true.

Deviation.—How the amount of local deviation is ascertained practically; how allowed. Examples of correction of courses for variation and deviation.

Leeway.—Definition. Starboard tack, port tack, close-hauled. How leeway is to be allowed. Examples.

The Log.—Description. How divided. Ordinary and patent.

Sounding.—Instruments used for.

Plane Sailing.—Construction of figures. Proof of formulæ used in plane sailing, viz., connecting nautical distance, difference of latitude, departure and course. Examples.

Traverse Sailing.—Definition of a traverse. To resolve a traverse. Construction of traverse table. Examples.

Middle Latitude Sailing.—To prove the formulæ used. Examples.

Second Stage or Advanced Course.

Mercator's Projection and Chart.—Principle, use, and advantages. Proofs of rules used in Mercator's sailing. Examples.

DEVIATION.—Sub-permanent and induced magnetism. Laws of induced magnetism in a ship. Semicircular and quadrantal deviation. Description of modes for ascertaining the amount of deviation.

GREAT CIRCLE SAILING.—Given the latitude and longitude of two places, to find the distance between them on a great circle. To find the latitude and longitude of the vertex. To find a succession of points on a great circle between two places. Examples.

Errors to which the log is liable. Having given the apparent distance run with given known errors in log line and glass, to find the true distance.

To find the difference of longitude made on a traverse. Taking a departure. Log-board and log-book. Day's work. Examples.

EXAMINATION FOR HONOURS.

In addition to the above, will be required :—

CALCULATION OF TABLES.—(*a.*) Traverse tables.
(*b.*) Meridional parts.

MERCATOR'S CHART.—Practical construction.

MAGNETISM OF SHIPS.—Full knowledge of determination of co-efficients A B C D E. Heeling error. Compensation of compasses. Napier's graphic method.

NAUTICAL SURVEYING.—Problems in, not requiring a knowledge of nautical astronomy.

CYCLONES.

SUBJECT XXI.—NAUTICAL ASTRONOMY.

FIRST STAGE OR ELEMENTARY COURSE.

Definitions in Nautical Astronomy.

TIME.—Civil and astronomical. Apparent and mean solar; to convert the one into the other. Conversion of arc into time and time into arc. Greenwich date.

EQUATION OF TIME.—General account of, and use.

Explanation and use of the Nautical Almanac, so far as is necessary for finding the latitude and longitude from observations of the sun.

THE SEXTANT.—Construction and use of, with its adjustments.

CHRONOMETER.—Use of; error and rate.

CORRECTIONS OF ALTITUDE.—Causes and general description of, and use of tables.

To prove the rules and work examples in the following problems :—

1. To find the latitude by meridian altitudes of the sun.
2. To find the longitude by chronometer and altitude of the sun.
3. To find the error of chronometer by a single altitude of the sun.
4. To find the variation of the compass—
   (*a.*) By amplitudes of the sun.
   (*b.*) By altitude-azimuth.

SECOND STAGE OR ADVANCED COURSE.

TIME.—Sidereal time. To convert intervals of mean into sidereal time, and vice versâ. Meridian passage of heavenly bodies.

NAUTICAL ALMANAC.—Full explanation, and use of pages i–xviii, and the two Tables of places of fixed stars, viz.: "Mean Places for January" and "Apparent Places at Upper Transit at Greenwich." To take out a planet's right ascension and declination.

Corrections for Altitude.—Investigation and construction of tables for—

1. Dip.
2. Refraction.
3. Parallax.
4. Semidiameter.

To prove the rules and work examples in the following problems :—

1. To find the latitude by meridian altitude of star, planet, or moon.
2. To find the latitude by Polaris.
3. To find latitude by ex-meridian altitude of sun, star, moon, or planet.
4. To find latitude by double altitude of sun, star, planet, or moon, or combination of them.
5. To find the longitude by star or moon chronometer.
6. To find the error of chronometer by a single altitude of a star, and to find the rate of the chronometer.
7. To rate chronometer by equal altitudes.
8. To find variation of compass by Time-azimuth.

Lunar Distances.—To explain generally the method of finding the longitude by lunar distances, and to work examples.

To describe and work examples in Sumner's method of determining the position of a ship.

Tide Tables.—Explanation and use of "Establishment of Port."

Honours.

In addition to the above, will be required—

To work problems on time.

Full knowledge of the Nautical Almanac. Complete explanation and calculations of nautical tables for corrections, &c.

Estimation of the most advantageous times and circumstances for different observations and degree of dependence.

"Equation of Equal Altitudes."

Investigation of the problem of longitude by lunar distance, and different methods of clearing the distance.

Theoretical and practical knowledge of all the methods of determining the latitude, longitude, and variation of the compass.

Miscellaneous problems, such as time of rising and setting of heavenly bodies, twilight, &c., &c.

Tides.

Surveying.—Problems requiring a knowledge of nautical astronomy.

The Examination will consist of a preliminary written paper, and, for those who qualify therein, of a practical examination at South Kensington at a subsequent date.

SUBJECT XXII.—STEAM.*

First Stage or Elementary Course.

Students in this course will be required to possess some knowledge of the effects of heat on matter, such as changes of temperature, expansion, change of elasticity, vaporization, liquefaction; they must also know something of the phenomena of the radiation, absorption, conduction, and convection of heat; they will be liable to questions relating to the mechanical equivalent of heat, as well as to the conversion of work into heat and of heat into work; they must also inform themselves on the following subjects, viz., the causes which influence the boiling temperature of water, the boiling points of fresh and salt water, high-pressure steam, measure of steam pressure by atmospheres, the relation between the pressure, density, and temperature of steam, the specific volume of steam, the latent heat of steam, the quantity of water required to produce condensation, the distinction between saturated and superheated steam.

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* *This syllabus has been recast.*

EARLY ENGINES.—Newcomen's atmospheric engine, its defects. The discoveries of Watt. Hornblower's compound engine.

THE SINGLE-ACTING CONDENSING PUMPING ENGINE.—Details connected with this engine; the steam cylinder, the steam, equilibrium, and eduction valves, their action; the steam-jacket, the clothing of the cylinder; the condenser, the air-pump, the foot-valve, the delivery valve, the snifting valve, the hot well; the piston rod, stuffing boxes and glands; the construction of the beam in large engines, the plug rod, the parallel motion; the method of starting the engine, and of regulating its speed, the construction and action of the cataract.

DOUBLE-ACTING CONDENSING ENGINE.—Details of the various parts, the cylinder, how constructed, the ports or openings into the cylinder; the various forms of valves in common use, the methods of balancing valves, the three-ported valve, the lap on a valve, the lead of a valve, the eccentric; details of the piston, metallic packing rings; the air-pump, jet condenser, the surface condenser, gauges for the condenser, the barometer gauge, method of estimating pressure by it, errors in this method, and correction of the same; the crank and connecting rod, the strap, gib, and cotter, the beam, parallel motion in beam engines, the governor, the flywheel; stopping and starting gear. Various types of direct-acting condensing engines.

THE NON-CONDENSING ENGINE.—Various types of direct-acting engines.

THE EXPANSION OF STEAM.—Saturated and superheated steam; law of expansion; the object of expanding steam; modes of carrying out expansive working. Expansion valves; double beat valve, crown valve, gridiron valve; wire drawing of steam, the throttle valve.

STATIONARY BOILERS.—The Cornish boiler, the Lancashire boiler, the vertical boiler; heating and fire-grate surfaces, the evaporative power of boilers, boiler chimneys; the strength of boilers, the use of stays, the proving of boilers. Boiler appendages; safety valves, reverse or atmospheric valves, communication or stop valves; the glass water gauge, steam pressure gauge, various forms, the heating of feed water, feed pumps. Priming, its causes and remedies.

THE MARINE STEAM ENGINE.—Various types of paddle-wheel engines; the oscillating and inclined engine, various types of screw propeller engines. Details of parts connected with the working of marine engines, expansion and reversing gear; bilge and feed pumps.

MARINE BOILERS.—General forms and construction; tubes and flues; the funnel and its casing; fire-bridge and ashpit, waste steam pipe, water gauge, gauge cocks, pressure gauges, safety valves, reverse valves, stop valves, feed pumps, boiler hand-pumps; feed or donkey-engine; Kingston's valves, blow-out cocks, brine-pumps and brine-valves; the methods of ascertaining the degree of saltness of the water in a boiler, amount of saltness permissible; formation of scale; superheating apparatus; surface condensation.

THE LOCOMOTIVE ENGINE.—The general construction of a locomotive engine and boiler before the invention of Stephenson; description of the Rocket engine as the type of the modern locomotive, the tubular boiler, the draught produced by the discharge of waste steam.

DETAILS.—Inside cylinders, outside cylinders, steamways, ports, slide valve; water cocks, grease cocks, the piston and packing-rings, piston-rod, guides, connecting rod, eccentrics, the reversing or link motion, reversing lever, sector, expansive working; crank axle and driving wheels, power required for traction, adhesion of the driving wheels, counter weights to cranks, wheels and axles, axle-boxes, bearing springs, buffer and draw springs, friction brakes.

THE BOILER.—The fire-box, the inner and outer shell, the cylindrical barrel, the tubes, mode of fixing them, fire-box stays, gusset stays; the ash-pit, the smoke box, the blast pipe, mechanical action of the blast; the steam chest, the outer dome, the steam pipe, the regulator, safety valves, pressure gauges; whistles, blow-off cocks, feed pumps, Giffard's injector; evaporative power of the boiler, fire-grate and heating surface, combustion of fuel; the

tender, water-tank, tank-engines, brake, feed pipes; coke-burning engines, methods of consuming smoke in coal-burning engines. Ramsbottom's method of filling the tender.

In this examination it is essential that the student should acquire the power of making hand sketches of the various parts which he may be called upon to describe. The observations made in the syllabus for Applied Mechanics hold equally in this subject, and it is further to be noted that the student is liable to be questioned as to the mechanical principles involved in any of the matters herein mentioned.

Second Stage or Advanced Course.

Students will be examined in the subjects already set forth, but will be expected to show a more extended knowledge of the same, and they should now be prepared also to answer questions in accordance with the second part of the syllabus as follows:—

Valves and Valve Gears.—Various types of valves, the double and treble ported, the piston, the Trick, and other valves. Meyer's expansion valve. The position of eccentrics on the crank-shaft; Zeuner's valve diagrams; effect of length of rod in modifying steam distribution. The valve motions or gears of Stephenson, Hackworth, Marshall, Corliss, Joy, and others. Expansion valves for compound engines. The distribution of steam in various types of compound engines.

Condensation.—Surface and jet condensers. Extent of surface required in surface condensers. Amount of water necessary for the condensation of steam. Construction of air pumps and circulation pumps. Ejector condensers.

Compound Engines.—Various types of compound engines, triple and quadruple expansion engines. Webb's compound locomotive engine.

Fly wheel and Governors.—Theory of their action. Proper diameter and weight for fly-wheels, details of construction of the fly-wheel. Construction and action of Watt's pendulum governor, of the Porter governor, and of other high speed governors. The parabolic governor.

The Indicator.—Description of the instrument, the atmospheric line. Method of taking a diagiram. The general configuration of diagram to be expected under various circumstances. Examination of the indicator diagram when the steam is throttled; when expansive gear alone used, and in other cases. To ascertain the horse-power of an engine by means of the indicator. The indicator-diagram in engines of various types. The combining of the indicator cards of a compound engine.

Propellers.—Paddle wheels, feathering of the floats, disconnection and immersion of wheels. The screw propeller, various forms, length, angle, pitch, and area of screw blade, disconnecting and raising the screw; the position of the screw propeller in the vessel, twin screws, the slip of the screw; the method of receiving the thrust upon the vessel, soft metal and hard wood bearings.

Theoretical Portion.—Work done during the conversion of water into steam; work done in a steam cylinder when the steam is expanded; work done in the air-pump; work developed by a crank; inertia of reciprocating parts, diagram of crank pin effort. Method of measuring the efficiency of a steam engine; meaning of absolute temperature; isothermal and adiabatic curves; efficiency of heat engines; experimental testing of engines; estimation of loss of fuel by "blowing out"; calculations relating to parallel motions, such as Watt's and Peaucellier's; estimation of the relative positions of the piston and crank in any part of the stroke; diagram showing the relative motions of the slide and piston; dynamometer, its use in finding the horse-power of an engine.

In order to encourage the study of the gas engine some questions will be set in the advanced course, which will embrace the following subject-matter; but these questions will not be compulsory.

Hot-air and Gas Engines.—General principles underlying the action of such engines. Stirling's hot-air engine; the regenerator; the construction of refrigerating machines. The efficiency of air engines. Explosive mixtures of gas and air. The Lenoir engine. The Otto engine. Details of construction of the Otto engine. The valves required, their construction and action. The charging of the cylinder. The firing of the charge. Mechanism for operating the valves, for regulating the speed, and for admitting the gas. Fittings of the engine. The cycle of operations. The indicator diagram. The efficiency of the engine.

Honours.

The range of subjects will comprise the whole syllabus, and students will be expected to show a more extended knowledge, both in a theoretical and practical direction, than is required of them in the second stage.

SUBJECT XXIII.—PHYSIOGRAPHY.

Note.—Demonstrations and Practical Work in Astronomical Physics at the Royal College of Science, London (price 6*d.*), may be obtained on application to the Department. [*See* list of publications at end of the Directory.]

First Stage or Elementary Course.

Matter and Energy.—Elementary ideas of the various conditions of matter as regards stress, motion, and energy, embracing heated states, electric and magnetic states, cohesion and gravitation.

Elementary Notions of Chemical Action.—The formation of binary compounds. Breaking up of compound matter into simpler forms. The chemical elements.

Water, its composition and different states.

Chemical and Physical Characters of the Crust of the Earth.—The chemical elements of which the crust is chiefly composed. The most abundant binary compounds occurring in mineral bodies. Difference between crystalline and non-crystalline substances. The common rock-forming minerals. Granitic rocks and volcanic products; Lavas, scoriæ, pumice, and dust. Sedimentary rocks. Conglomerates, sandstones, shales, and clays. Rocks of organic origin and their chemical composition. Chalk, coral-rock, and other limestones. Peat and coal. Altered rocks; slates, schists, gneiss. Nature and origin of soils.

Internal Terrestrial Phenomena.—Observations indicating an increased temperature in the interior of the earth. Volcanic phenomena and distribution of volcanoes. Earthquakes and slow upheavals or subsidences of the Earth's crust.

The Sea.—Salts dissolved in sea water, depth and form of sea bottom, remarkable inequalities. Distribution of temperature and density.

Phenomena of arctic and antarctic regions. Floes, pack-ice, ice-bergs, &c. Action of the sea upon the Earth's crust.

Influence of the sea in the distribution of climate.

The Atmosphere.—Height and composition; atmospheric pressure; use of the Barometer. Distribution of temperature, horizontal and vertical. Use of the Thermometer.

Evaporation and condensation. Aqueous vapour, rainfall, ice and snow. Regions of extreme dryness and of great rainfalls.

Land and sea breezes. General conditions of climate.

Action of rain, springs, rivers, and glaciers upon the Earth's crust.

General ideas of the changes which the Earth's surface has undergone in the past.

TERRESTRIAL ELECTRICITY AND MAGNETISM.—Elementary notions as to the indications and effects of terrestrial electricity and magnetism. Thunderstorms; aurora; the mariner's compass.

THE MOVEMENTS OF THE EARTH AND THEIR RESULTS.—Methods of measuring angular space and time. Proofs of rotation and revolution. The Earth's orbit. The plane of the Ecliptic and plane of the Equator. Effects of rotation and revolution. The distribution of light and heat on the Earth's surface. Day and night. The Year. The Seasons.

SECOND OR ADVANCED STAGE.

Questions may be set in all the topics included in the elementary course, and in addition in the following ones:—

GENERAL SURVEY OF THE SOLAR SYSTEM.—Major planets; minor planets. Inclination of the equatorial planes of the chief planets to the ecliptic; nodes. Satellites. Inclinations of orbits. Comets and Meteors; peculiarities of their orbits.

DIMENSIONS OF THE SOLAR SYSTEM.—Measurement of the surface, size, and true shape of the Earth. General idea of the work of Geodetical surveys and the instruments employed. Measurement of the distance of the Moon and Sun. Sizes of planets and satellites. Diameters of orbits of satellites.

GRAVITATIONAL ENERGY.—Interaction of mass on mass (gravitation). Measurement of the Earth's density; methods employed and results obtained. Effects of the gravitational energy of celestial bodies on the Earth. The form of the Earth's orbit, and its varying speed during revolution round the Sun. Combined effect of the Sun and Moon on the ocean; the tides and their effects. Precession; nutation; changes in the line of apsides.

STUDY OF THE RADIANT ENERGY OF CELESTIAL BODIES.—Classification into hot and cold masses; bodies studied by their radiation alone; by their radiation and absorption; by their reflection; general idea of the distribution of these masses, and of the dimensions of the sidereal system. Stars; classification according to their spectra; variable stars; coloured stars. Nebulæ. Comets and meteorites.

PHYSICAL AND CHEMICAL CONSTITUTION OF THE SUN.—Solar spectrum; Fraunhofer lines. Physical features; size and mass. Distribution of Sun spots and prominences; spot and prominence periods.

TERRESTRIAL EFFECTS OF THE SUN'S RADIANT ENERGY.—Effects on the atmosphere; changes in barometic pressure; how air currents are produced; trades; cyclones and anticyclones; monsoons; changes of direction of air currents. Effects on the ocean; the chief streams and currents. Effects on the vegetable kingdom. Explanation of the daily and yearly changes in the meteorology of the Earth. Possible eleven yearly changes. The various causes of secular changes of climate and their effects. Changes in the distribution of terrestrial magnetism and electricity. Instruments and methods employed. Secular changes in the magnetism of the Earth.

THE OTHER PLANETS AND SATELLITES OF THE SOLAR SYSTEM COMPARED WITH THE EARTH AND MOON.—Masses. Densities. Rotation periods. Atmospheres. Temperatures. Surface markings.

THE EARTH AS A COOLING GLOBE.—The secular cooling of the Earth. The Earth's interior. Conditions of a cooling and contracting globe. The present conditions of non-terrestrial matter as throwing light on the past history of the earth. Comparison of solar and terrestrial chemistry. Kant's hypothesis.

HONOURS.

The candidate must possess a sound knowledge of all the subjects contained in the syllabus, but he will be expected in addition to show a thorough acquaintance with one of the main groups, including the advances which have recently been made in it.

N.B. In the examinations in the elementary and advanced stages questions will be given in two groups; one of them containing questions which relate

principally to physical geography, and the other will contain questions in the other part of the syllabus: students will be required to answer questions in both groups.

SUBJECT XXIV.—THE PRINCIPLES OF AGRICULTURE.*

First Stage or Elementary Course.

The object in this stage is to lay a ground-work of elementary facts and principles; unless these are clearly understood there can be no accurate knowledge of the subject.

The paragraphs in brackets are designed for the use of the teacher, and enumerate the subjects he is expected to treat of. The teacher should illustrate his lessons, as far as possible, by exhibiting the objects spoken of, or by showing diagrams† or drawings, or by performing experiments. Some suggestions regarding experiments will be found at the end of this section. Examples should be chosen, by preference, from local objects and practices, as these will possess the greatest interest for the class.

It is very desirable, *if not absolutely essential, that in order to obtain any real knowledge or grasp of the principles of Agriculture*, a course of Elementary Chemistry, such as the alternative First Stage in Subject X., should precede any attempt to teach them, and it is very probable that *stringent measures insisting upon this will be taken* before long. Where this previous instruction has not been given, the teacher has many explanations to give which must greatly interfere with the thread of his teaching.

1. Plant Composition.—Proportion of water, combustible matter, and ash; chemical elements in each. The essential constituents of plants. Distribution of ash constituents in the plant. General composition of farm crops.

[First object of agriculture the production of crops, the second the breeding and feeding of animals. Composition of plants, proportion of water and solid matter. Division of solid matter into combustible and incombustible. Percentage of ash yielded by corn, straw, hay, roots, &c. Chemical elements contained in the combustible constituents. Chemical elements in the ash of plants. Ash constituents which are essential for all plants. Non-essential, yet often useful ash constituents. Distinction between essential and non-essential ash constituents, how ascertained. Characteristic differences between the composition of the ash of grain, and that of straw or leaf. Quantities of dry matter, nitrogen, and principal ash constituents, in ordinary crops of wheat, beans, meadow hay, clover, turnips, mangel, and potatoes, in pounds per acre. Classification of crops according to composition. Possible replacement of one ash constituent by another when crops are grown on different soils.]

2. Plant Life.—Chemical elements obtained from the air. Action of light on chlorophyll cells; formation of organic matter. Chemical elements obtained from the soil. Action of the roots. Life history of annuals, biennials, and perennials. Formation of seed. Germination.

[Chemical elements obtained by the plant from air. Composition of the atmosphere. Substances in air serving as plant food. Assimilation of carbon, hydrogen, and oxygen. Function of the chlorophyll cell. Action of light and heat. Distinction between the nutrition of green plants and of those destitute of chlorophyll. Formation of organic matter. Plant respiration. Chemical elements obtained from soil. Plant transpiration, amount of water evaporated by crops. Influence of depth and distribution of roots; differences in this

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* *This syllabus has been recast.*

† A few diagrams have been specially prepared for this course, and may be obtained from Messrs. Chapman and Hall.

respect in various crops. Assimilation of plant food from the soil. Rain water, its action in the soil. Composition of the solution in a soil. Assimilation of nitrogen; nitrogenous substances in soil acting as plant food. Special nutrition of Papilionaceæ, how proved. Solvent action of root hairs on inorganic materials in the soil; substances specially assimilated in this way. Destination of the ash constituents in the plant. General differences in the life history of annuals, biennials, and perennials. The storing up of plant food for a second season. The exhaustion of the plant during the formation of seed. General structure and composition of seeds. Germination; conditions essential for. Points to be remembered in sowing seeds on a farm. Chemical changes during germination, conversion of reserve matter into soluble nourishment.]

3. Soil Physics.—Conditions of a mass of small particles. Properties of sand, clay, humus, and calcareous matter. Heavy and light soils. Capacity for water of soils. Capillary action. Evaporation. Treatment of wet and dry soils. Sources of heat. Circumstances which influence the temperature of soil and sub-soil.

[Soil considered as a mass of small particles of various sizes. Circumstances which determine the total surface of the particles, and the proportion of the space between them. Influence of porosity of the particles. Hardness, specific gravity, and physical characters of quartz-sand, limestones, clay, and humus. Difference in adhesiveness of coarse and very fine sand. Clay, a mixture of extremely fine sand and a small quantity of a colloid body; evidence for this. Coagulation of clay by lime. Differences in physical characters of soil according as clay is coagulated or uncoagulated. Action of dressings of lime or chalk on heavy land. Humus, its origin; roughly divided into humin and humates. All humates colloid bodies. The principal cementing materials in soil, clay and humates; their action separately and together. So-called "heavy" and "light" soils. Their physical characters, how improved. Effect of the treading of sheep. Explanation of terms such as "loam," "clay," "marl," "peat."

Circumstances which determine the capacity for water of soils when saturated. Adhesion of water to surfaces; capillary attraction. Capacity for water of soils when drained. Evaporation from soils when saturated; influence of time of year. Evaporation from soils when drained. Circumstances in which water is brought to the surface by capillary attraction. Influence on evaporation of looseness of texture, of stones, of surface-cultivation and mulching, of crops and weeds. Practical applications of these facts; effect of ploughing, summer cultivation, hoeing, rolling. Wet and dry soils. Influence of subsoil on soil moisture. Water level in subsoil. Treatment of wet and dry soils. Influence of draining, and of farmyard manure.

Heat from chemical action, example of hot-bed and damp hayrick. Amount of heat from this cause. Heat from the sun. Influence of atmosphere. Great influence of angle of incidence of sun's rays; aspect of fields. Mean temperature of soil, its variation with climate. Maximum and minimum temperature of surface soil compared with that of the air. Influence of colour on amount of heat absorbed. Night radiation. Specific heat of water, humus, clay, limestone, and quartz-sand, reckoned both on weight and volume; its influence on soil temperature. Conduction of heat by soil constituents; influence of fine or coarse division, loose or firm texture, dryness and wetness. Preponderating influence of water on soil temperature. Loss of heat by evaporation. Warm and cold soils. Effect of draining on temperature. Temperature of the subsoil at various depths.]

4. Soil Chemistry.—Origin and chemical nature of sand, clay, calcareous matter and humus. Effect of weathering, of vegetable and animal life, and of tillage. Retentive power of soil for plant food. Oxidation in soils under various conditions. Circumstances determining the accumulation or diminution of nitrogenous organic matter in the soil. Composition of soil per cent. and per acre. Active and inactive condition of elements of plant food.

[Describe the history and formation of some soil in the neighbourhood. Describe sand, its origin and constituents; clay, its origin and constituents; calcareous matter, its origin and constituents; humus, its origin and compo-

sition. Point out the general distribution of plant food among the ingredients of soil. Effect of "weathering" on the inorganic constituents of soil; disintegrating action of frost, solvent action of water containing carbonic and humic acids. Effect of autumn tillage and bare fallow. Effect of vegetation accumulating humus at the surface. Action of animal life, worms, moles, ants, &c. in the soil. Differences between surface soil and subsoil.

The absorptive or retentive power of soils towards ammonia, potash, magnesia, lime, and phosphoric acid. Substances for which soil has little or no retentive power. The absorptive action of humus, hydrous silicates, and hydrated ferric oxide. Influence of lime in assisting the absorption of bases from salts. Difference in the retentive power of various soils; importance of this fact as regulating the choice and time of application of manures.

Oxidation of organic matter in soils, action of animal life, fungi, and bacteria. Final products of oxidation. Origin of saltpetre and nitrate of soda. The nitrifying bacteria; in what part of the soil most abundant. The effect on their action of varying conditions of temperature, supply of water and oxygen, and of basic matter. Effect of tillage on production of nitrates. Accumulation of nitrates during bare fallow. Influence of manure on the production of nitrates. Solubility of nitrates, their removal into the subsoil and into drainage and well-water. Action of crops in taking up the nitrates in the soil, and in diminishing drainage. Conditions favourable to the diminution of the nitrogenous organic matter of the soil. Conditions favourable to the accumulation of nitrogenous organic matter. The root and stubble residue left by various crops. Special effect of laying down land in pasture, and of the cultivation of deeply rooted leguminous crops. Effect of farmyard and other organic manures.

Show chemical analysis of a soil, if possible one in the district. Mention quantities per cent. of nitrogen, phosphoric acid, potash, lime, and magnesia, found in common soils, fertile and infertile; show their amount in pounds per acre to a depth of nine inches. These constituents mostly insoluble; practical importance of this fact. Nature of soluble matter shown by composition of drainage waters. Action of plant roots upon insoluble inorganic plant food depends on its condition. Illustrate from published experiments that abundance of nitrogenous matter, phosphates, and potash may exist in a soil, and yet the crop starve for lack of them. Distinction between active and inactive plant food. The great value of manures supplying food immediately available to the crop; the fertility thus imparted soon exhausted. Distinction between the permanent fertility of a soil and the condition superinduced by high farming.]

5. TILLAGE.—Implements, and effect of tillage.

[Describe the ordinary plough, cultivator, harrow, and roller, and point out the special action of each. The importance of tilth. Recapitulate the effect of tillage operations on the water, heat, weathering and oxidation of the soil, and show how the special mode of tillage can be altered to meet varying requirements.]

6. MANURES.—Object of manuring. Liming, its effect. Constituents of farmyard manure, circumstances which determine its value. Different kinds of litter. Box and yard feeding. Fermentation of dung. Its characters as a manure. Bones; soils and crops most benefited by them. Superphosphate; its manufacture, its special advantages. Use of nitrate of soda and kainite.

[Object of manuring the increase or maintenance of the fertility of land. Removal of plant food from land by drainage, crops, and animal produce; return of plant food in manure.

Application of chalk, marl, or lime, an ancient practice. In chalk and marl lime is combined with carbonic acid, as in soil. Continual waste of lime from surface soil. Recapitulate physical and chemical effects of carbonate of calcium in soil. It also aids decomposition of silicates, neutralises humic acid, promotes oxidation of vegetable matter. Lime, how prepared from limestone; its behaviour with water (hence "quick" or endowed with *life*); the chemistry of these processes. Chemical effects of lime at first far more energetic than those of chalk. The conversion of lime into carbonate in the

soil. Lime from dolomite (if this is a local rock), the difference in its composition and action. Give detailed composition of marls, if these are used locally. Soils and crops specially benefited by liming. Quantities of chalk and lime applied. Precautions necessary when quicklime is employed.

Farmyard manure composed of liquid and solid excrements plus litter. Solid excrements are undigested matter; liquid, contain the nitrogenous waste products of the body, principally urea. Distribution of ash constituents between them. Comparative value of liquid and solid portion. Richness of manure dependent on character and amount of food, and on the use made of food by the animal. The manure of different animals, characteristic differences as to proportion of water. Different kinds of litter, their composition and absorptive power. Quantity of litter required for a horse, cow, and fattening ox, and quantity of fresh manure yielded. Fermentation of urea. Losses of ammonia in stable from various animals; how best diminished. Box feeding, its advantages. Feeding in open or covered yards, its advantages and disadvantages. Losses by drainage. Liquid manure, its composition; how dealt with. Formation of manure heap. Fermentation of dung, its results. Losses in the manure heap, how prevented. Advantages of applying fresh manure to the land. Composition per cent. and per ton of farmyard manure. Its character as a general manure. Its influence upon the physical properties of soils. Quantity available for use on a farm; how best employed. Slow action of the plant food it contains. Advantages of feeding animals upon the land.

Bones, fresh, steamed, and boiled, their composition. Forms in which employed. Soils and crops most benefited by their use. Quantities applied. Slowness of action.

Superphosphate, the object of its manufacture. Chief materials used. Chemistry of the process. Meaning of the terms tricalcic, dicalcic, and monocalcic phosphate, also of the commercial "soluble," "reverted," and "insoluble" phosphate. Composition of superphosphate. Its action as manure compared with bone. Soils and crops most suitable for its use. Quantities applied. The combinations formed by phosphoric acid in the soil.

Nitrate of soda, whence obtained. Its composition. Nitrates a natural plant food. Soluble, not retained by the soil. Precautions necessary to employ nitrate of soda advantageously. Crops most benefited by its use. Quantities employed.

Kainite, its composition, its origin. Freely soluble, but potash and magnesia retained by a good soil. Soils and crops most benefited by it. Quantities applied.]

7. Crops.—Composition in pounds per acre of average farm crops. Exhaustion of land by sale of crops. Special characteristics of different crops; influence of these on their selection and manuring.

[Show amounts of dry matter, nitrogen, phosphoric acid, potash, lime, and silica, in average crops of wheat, barley, oats, meadow hay, red-clover hay, beans, turnips, mangel and potatoes, and any other crops common to the district, in pounds per acre. Classify as rich or poor in nitrogen, in potash, in silica. Regard separately the part of the crop removed from the field, or sold off the farm, pointing out what procedure exhausts the land most in important ash constituents. Show, if possible, what is the loss to the land by sale of products in any simple rotation usual in the district.

Point out the suitability of different crops for the various climates in Great Britain, and any marked preference of particular crops for a special kind of soil. Show the differences in the root development of crops, their length of period of growth, the feeding power of their roots. What is easy for one crop to obtain is difficult for another. Compare wheat and beans as to their capacity for obtaining nitrogen and silica, and turnips and mangel as to their capacity for obtaining phosphates from the soil. The selection of manures is generally based on the special needs of the crop, and not on its composition; a general manure frequently not required. Show from published experiments the effect of nitrate of soda on cereal crops and mangel, and the effect of superphosphate on barley and turnips. Some crops, as potatoes and pasture, usually require a general manure.]

Suggested Experiments.

Ash of Plants.—Twist a piece of stout platinum or iron wire round two or three inches of a small bough, and burn over a Bunsen or spirit flame upon a plate. Observe that the bark yields the most ash.

Carbonic Acid in Air.—Expose clear baryta or lime water to air in a beaker at the beginning of the lesson. Observe the film formed on the surface, composed of barium or calcium carbonate.

Production of Starch in Sunlight.—Gather a few leaves (the leaves of seedling cabbage plants answer the purpose excellently), and keep them for some hours in a warm moist atmosphere in the dark. Gather leaves from same plant after some hours' exposure to sunshine. Examine both leaves for starch by dipping them successively into boiling water, into methylated spirit till white, into cold water, and finally into a weak solution of iodine in potassium iodide.

Starch Stored up in Autumn.—Take a thin section of large bough of beech, ash, oak, or elm, felled in winter, and treat successively with boiling water and with iodine solution. Observe where starch has been deposited.

Reserve Matter made Soluble by Germination.—Show that ground pale malt is soluble to a large extent in warm water (temperature 130° Fahr.), and yields a sweet solution, while barley meal is practically insoluble.

Coagulation of Clay by Lime.—Mix clay soil with rain water. After subsidence fill two beakers with the turbid liquid; to one beaker add a few drops of a strong solution of calcium chloride, and stir. Note the rapid precipitation of the clay.

Humates in Soil.—Place some powdered garden soil on a filter, and pour upon it a weak solution of ammonium carbonate. The insoluble humates will be decomposed, and pass into the filtrate as ammonium humate; the humin will remain on the filter unchanged. On adding an excess of calcium chloride to the filtrate the humic acid is precipitated as calcium humate, along with calcium carbonate. It is better to use ammonia in place of the carbonate, if the soil will yield a dark coloured solution when so treated, as in this case the calcium humate can be precipitated without the carbonate.

Capillary Action.—Show the rise of a coloured liquid, as ink and water, in white blotting paper.

Specific Heat.—Take two cylinders of iron and tin, of the same shape and weight. To prepare these, cut off 1¼ inch of rod iron, ¾ inch in diameter, make a mould from it in plaster; take the same weight of tin as iron, melt it and pour it into the mould. Attach wire or string to the cylinders so that they can be suspended. Immerse both in boiling water. Take them out simultaneously, and place them on a cake of wax supported by its edges. The wax should be of such thickness that the hot iron perforates it and falls through, while the tin remains supported.

Cooling by Evaporation.—Place a few drops of water on a block of wood, and then stand a small beaker on it. Place a little ether in the beaker and blow over it with a pair of bellows. The evaporation of the ether will freeze the water.

Washing out Nitrates from Soil.—Place some powdered garden soil on a filter, and pour upon it a little water. To the filtrate add a few drops of a solution of diphenylamine in sulphuric acid, and then very gradually and cautiously some oil of vitriol; a dark blue colour will show that nitrates are present in the solution.

Second Stage or Advanced Course.

The subjects on which students will be examined in this stage comprise all those enumerated in the first stage, with the following in addition:—

8. Atmosphere.—Detailed composition. Rain and dew, their composition. Condensation of water on plants and soils.

9. Soils.—Mechanical analysis of soil. Clay-burning, its uses. Hygroscopicity. Absorption of ammonia, and of nitrogen (?) from the air. Movements of salts in soil. Formation of "pan" in soils. General principles of draining. Special advantages of steam tillage. Causes of infertility.

10. Manures.—Green crop manuring. Feeding sheep or cattle on the land. Comparative manurial value of ordinary foods. Liquid manure. Seaweed. Guano. Fish manure. Sulphate of ammonia; its comparison with nitrate of soda. Soot. Wool refuse. Basic slag. Gypsum. Common salt. Price per unit of manure constituents; how reckoned. Mode and time of application of manures, and quantities employed. Conditions of soil and climate which should influence the selection of manures. Return in crop for manure applied. Composition of drainage waters from manured land.

11. Seeds.—Per-centage fertile, how determined. Circumstances affecting the germinating power of seed, and the vigour of the plant produced. Change of seed. Impurities and adulterations. Quantities of seed per acre.

12. Crops.—Botanical position of common British crops. New varieties; how produced. Composition in different stages of growth. Chemical changes in the ripening of grain, root, and fodder crops. Influence of season and climate on the amount and quality of produce. Production of malting barley. Influence of the special tillage and period of growth of various crops upon the utilisation or waste of soil nitrogen. Cereals, why commonly called exhaustive. So-called restorative crops. Rotations, why adopted. Examples of rotations to suit varying conditions. The use of catch crops. The statistics of the farm: soil constituents sold as vegetable and animal produce, and returned as purchased food and manure.

13. Meadow and Pasture.—Laying down land to grass; the seeding and subsequent treatment most suitable for temporary or permanent grass land. Accumulation of nitrogen in the soil under these conditions. Names and characters of the commonest grasses, leguminous plants, and weeds in meadow and pasture. Species adapted to various soils and climates, and for early or late growth. Effect on the botanical character of the herbage of mowing or pasturing, and treatment with various manures. Chemical composition of produce. Appropriate manuring of hay meadows and pastures.

14. Hay-making and Ensilage.—Gramineous and leguminous hay-crops, best time for cutting. Difference in composition between hay and green herbage. Crops used for ensilage. Process for making sweet or sour silage. Chemical changes during hay-making and ensilage. Relative advantages of these methods.

15. Diseases of Plants.—Mode of growth and nutrition of fungi. Rust, smut, bunt, ergot, potato disease, club root, and other diseases. Preventive and remedial methods. Insect pests. Preventive and remedial methods.

16. Live Stock.—Principal breeds of agricultural horses, cattle, sheep, and pigs in the United Kingdom; their distinguishing characters, and suitability for various purposes. The principles of breeding; natural variation, heredity, prepotency, reversion.

17. Animal Composition.—Rothamsted per-centage analyses of whole bodies of animals. Chemical elements in animals. Chief combustible constituents classified as (1) Nitrogenous—albuminoids, gelatinoids, keratin; and (2) Non-nitrogenous—fats. General per-centage of nitrogen in nitrogenous constituents. Composition of fats. Characteristic ash constituents of blood, muscle, and bone. Differences between the composition of different animals; alterations from youth to full age, and during fattening.

18. Animal Nutrition.—Essential differences between the nutrition of plants and animals; production of heat and work by animals. The principal constituents of cattle foods. Function of the albuminoids of food; production of nitrogenous tissues; production of urea; production of fat. Functions of amides, fats, carbohydrates, and ash constituents. Relative value (as producers of heat, work, and fat) of albuminoids, amides, fats, and various carbohydrates.

Processes of digestion and assimilation. Action of enzymes as hydrolysers. Special solvent action of saliva, gastric juice, and pancreatic juice. Difference between ruminants and non-ruminants. Action of bile. Digestion of cellulose. Absorption of dissolved food. Undigested matter. Functions of the blood; nutrition of tissues, supply of oxygen, removal of waste products. Nature of excretions by lungs, kidneys, and skin. Function of heart and lungs. Necessity for ventilation.

19. Foods.—Average per-centage composition of foods ordinarily used on the farm. Per-centage of true albuminoids, amides, and nitrates. Vegetable fats and wax. Per-centage of starch and sugars in foods. Pectin, pentosans, celluloses, lignin. Difference in value between immature foods and grain. Influence of the age of a crop, of season, and manuring, on its composition and nutritive value. Milling and brewing products used as food. Oil-cakes; composition, impurities, and adulterations. Foods in which ash constituents are deficient.

Digestibility of foods; how ascertained. Digestion coefficients of ordinary foods in the case of cattle, sheep, pigs, and horses. Relation between the digestive power of different animals and the diets suitable for them. Influence on digestibility of quantity of ration, bruising, chaffing, pulping, and cooking food, and of labour performed by the animal. Digestibility of green herbage and of hay compared. Influence of one food upon the digestion of another. Use of salt.

Comparative value of foods for the production of heat and work, also as sources of albuminoids (albuminoid ratios). Influence of proportion of water present. Influence of flavour. Use of condiments.

20. Diets.—Water required for different animals at rest and at work. Diet for young animals. Composition of milk of farm animals. Foods nearest milk in composition. Diet for adult animals. Maintenance diets; minimum of albuminous matter required; supply of combustible matter for heat and work when at rest. Labour diet; relation between food and work, influence of pace. Diet for fattening animals. Conditions necessary for economic fattening. Composition of animal increase while fattening. Returns yielded by oxen, sheep, and pigs for food consumed. Influence of manure value of foods on their selection. Relation of food to production of wool; composition of wool. Diet for milking cows. Influence of food on the quantity and composition of milk, and upon the quality of butter.

21. Dairy.—Importance of excellence in the cow for profitable dairy work. Quantity and composition of milk from various breeds. Variations in composition during lactation. Other circumstances influencing the composition of milk. Curdling of milk by bacteria; how prevented. Fat globules in milk. Methods of separating cream by skimming, and by centifrugal machines; their respective efficiency. Composition of skim and separated milk. Composition of cream. Ripening of cream. Process of churning; results obtained with the best modern churns. Composition of buttermilk. Working and salting butter. Composition of butter. Yield of butter from milk. Rennet, how prepared; its action on milk. Cheesemaking. Acidity of milk, how ascertained. Influence of alterations in the acidity and temperature of milk, the proportion of rennet, time for curdling, &c., on the quality of the cheese. Composition of whey. Methods of ripening cheese; the changes which occur. Composition of various kinds of cheese. Details of the manufacture of Cheddar cheese. Loss to the farm by sale of milk, butter, or cheese.

*** In consequence of the large amount of new matter introduced in the above syllabus the optional subjects are for the present omitted.

Honours.

No candidate will be allowed to pass in honours after the examination of 1895 without previously obtaining a first class certificate in the Advanced Stage.

The examination for honours will not be confined to the particulars mentioned in the preceding syllabus, a fuller knowledge of the various subjects will be required. Questions may also be put on any important recent additions to agricultural science.

Candidates for honours who pass the written examination will be required to pass a subsequent examination at South Kensington (Sec. 10, p. 29 of the Science Directory). There will be three supplementary examinations, and the candidate may select either of them. The subjects of the examinations will be selected from those mentioned below.

Examination A.

Practical Agricultural Chemistry.

Identification of various agricultural materials.

Qualitative examination of soils, marls, limestones, manures, drainage and potable waters, and oilcakes. Detection of adulterations.

Quantitive determinations in agricultural materials of total nitrogen, ammonia, nitric nitrogen, chlorine, sulphuric acid, phosphoric acid, lime, magnesia and potash.

Analysis of water for total solids, chlorine, ammonia, albuminoid ammonia, nitric nitrogen, and hardness.

Analysis of milk : determination of specific gravity, total solids, and fat.

[Analysis of roots and fodders for sugar, starch, cellulose, and true albuminoids.

Analysis of oilcakes for moisture, oil, nitrogen and sandy matter.

A *vivâ voce* or written examination on methods of agricultural analysis will be added.

Examination B.

Practical Agricultural Botany and Entomology.

Description and identification of the cultivated plants of British agriculture, of their seeds, and of the adulterations of the latter.

Description and identification of the plants commonly found in the herbage of meadows and pastures.

Description and identification of the weeds of arable land, with a knowledge of their relationship to cultivated plants.

Recognition of the more common diseases of cultivated plants due to the ravages of insects and fungi, and to other causes.

Recognition of the commoner insect pests of cultivated plants.

Examination C.

Agricultural Hygiene.

General conditions of health ; sanitary buildings, ventilation.

Unwholesome and poisonous foods. Impurities of drinking water.

Animal parasites ; their life history, prevention and destruction.

Infectious diseases ; nature of the contagion, mode in which diseases are transmitted, measures used to prevent their spread.

Human diseases derived from animals ; milk epidemics.

Disinfectants, antiseptics, and deodorisers ; their nature and action.

SUBJECT XXV.—HYGIENE.

No candidate can pass in the Elementary Stage or in the Advanced Stage of Hygiene who fails to satisfy the Examiners in Elementary Human Physiology.

Elementary Human Physiology.

1. The form, position, and use of the bones constituting the skeleton, with a general idea as to the build of the body, as well as the boundaries and position of contents of the various body cavities.
2. The structure and arrangement of the heart, chief blood vessels, and the circulation, with a knowledge of the general composition, uses, and phenomena of blood.
3. The structure and arrangement of the lungs, with a knowledge of the theory of respiration and the changes resulting therefrom in the blood and air.
4. The general structure and uses of the teeth, stomach, and intestines, including a knowledge of the process of digestion and assimilation.
5. The position, general structure, and uses of the liver, spleen, pancreas, kidneys, and bladder.

First Stage or Elementary Course.

1. Food, Diet, and Cooking.—Classification and uses of food substances. Animal food, vegetable food, condiments; diet, requisites for maintenance; cooking, roasting, and boiling; advantageous preparation of food; cooking apparatus.
2. Water and Beverages.—Different kinds of water, sources of water, good drinking water; sources of contamination of water and its deleterious effects; cisterns and wells; tea, coffee, and cocoa—preparation and effects; fermented drinks—effects.
3. Air.—Amount of air necessary for each person; movements of air brought about by changes of density; composition of air; impurities of air; deleterious gases.
4. Removal of Waste and Impurities.—Principles of ventilation; natural ventilation; washing and soap; removal of parasites; danger of dirt. Removal of house refuse.
5. Shelter and Warming.—Materials of clothing; sufficiency of clothing for infants and adults.
6. Local Conditions.—Soil, and its drainage; aspect; elevation.—Hill, plain, and valley; distance from the sea; influence of surrounding objects; winds.
7. Personal Hygiene.—Habits; exercise, rest, and sleep, cleanliness, attention to the action of the skin and bowels.
8. Treatment of Slight Wounds and Accidents.—Treatment of cuts, burns, scalds, bleeding, fits, drowning, suffocation, poisoning, bites, and stings.

Second Stage or Advanced Course.

Including the topics enumerated under the elementary course, and in addition the following:—

1. Food and Adulterations.—Economical and wasteful diets; calculation of diets.
2. Water and Beverages.—Action of water filters; constant and intermittent systems of service; aërated waters and other beverages.
3. Examination of Air.—Chemical and Microscopical.
4. Removal of Waste and Impurities.—Artificial ventilation; closets, sinks, and baths; good and bad drains; construction and ventilation of drains; water-traps; dry and wet methods of removal of sewage; treatment and utilisation of sewage; cesspools and main sewers; sewer gas and septic organisms; disinfectants, antiseptics, deodorisers.

5. Shelter and Warming.—Injurious clothing and modes of dressing; poisonous dyes; materials used in the construction of house walls and roofs, and their properties; foundations and basement floors, damp-proof courses; floors, covering of walls, dangerous papers; fire-places, stoves, and grates; products of combustion; radiation; warming by hot air and water-pipes; introduction of warmed air.

6. Local Conditions.—Rainfalls and moisture of the air.

7. Personal Hygiene.—Influence of sex, age, temperament, idiosyncrasy; heredity. School hygiene, care of the eyesight.

8. Prevention of Disease.—Prevention of endemic diseases, *e.g.*, consumption, scrofula, rickets, rheumatic fever—marsh diseases; prevention of the spread of epidemic diseases, *e.g.*, small-pox, scarlet fever, diphtheria, measles, whooping cough, typhus and typhoid fevers, cholera; isolation and disinfection.

Honours.

No candidate can obtain Honours unless he has previously passed in the Advanced Stage of this Subject, and in the Advanced Stage of Subject XIV., Human Physiology.

In addition to the topics enumerated under the Elementary and Advanced stages, questions will be set on the following:—

Trades nuisances.
Vital statistics.
Sanitary Law.
Meteorology.

APPENDIX E.

SYLLABUS OF ART SUBJECTS.

I.—An ILLUSTRATED SYLLABUS of the Course of Instruction in Drawing in Elementary Schools may be obtained, price 2*d.*, from the Department, or 3*d.* through Agents. [*See* list of publications at end of the Directory.]

II.—SYLLABUS OF SUBJECTS IN WHICH EXAMINATIONS IN ART ARE HELD BY THE DEPARTMENT OF SCIENCE AND ART.

Freehand Drawing of Ornament in Outline.

ELEMENTARY AND ADVANCED STAGES.

(SUBJECTS 2B and 3B.)

ELEMENTARY STAGE (SUBJECT 2B).*

(1½ *hour is allowed for the Examination in this stage.*)

Candidates are required to make an outline drawing from an example of ornament in outline which is supplied to them. Their drawing of it must be on a larger scale than that of the example supplied. It should fairly fill the quarter imperial sheet of drawing paper given to the candidate at the examination.

ADVANCED STAGE (SUBJECT 3B).

(2½ *hours are allowed for the Examination in this stage.*)

Candidates are required to make an outline drawing from a Cast, on an enlarged scale, so as to fairly fill a half imperial sheet of drawing paper. A portion, about 14 inches long, of one of the Louis XII. pilasters, with or without its capital or base, or one of the scrolls of the Madeleine pilaster, or such other cast of ornament, the size of which is in fair proportion to the half imperial sheet of paper will be used at the examination and will be supplied by the Department.

No ruling, measuring, tracing, or use of instruments is allowed.

Model Drawing.

ELEMENTARY AND ADVANCED STAGES.

(SUBJECTS 3A and 5A.)

In both stages each candidate is required to draw the objects placed before him, including the drawing board on which they stand, as they appear from the point of view in which he may be seated, and his drawing is expected to show a knowledge of the effect of perspective in modifying the appearance of the models.

No ruling, measuring, or use of instruments is allowed; but the pencil may be held between the eye and the objects for the purpose of estimating their apparent relative size.

N.B.—Models and vases must be of the sizes indicated in the accompanying figures (1 and 2).

* These examinations nearly correspond with the former 2nd Grade Examinations in these subjects.

Elementary Stage (Subject 3a).*

(1 hour is allowed for this Examination.)

Candidates are required to make an outline drawing in pencil only from a group of three or more of the geometrical models and simple vases shown in Fig. 1.

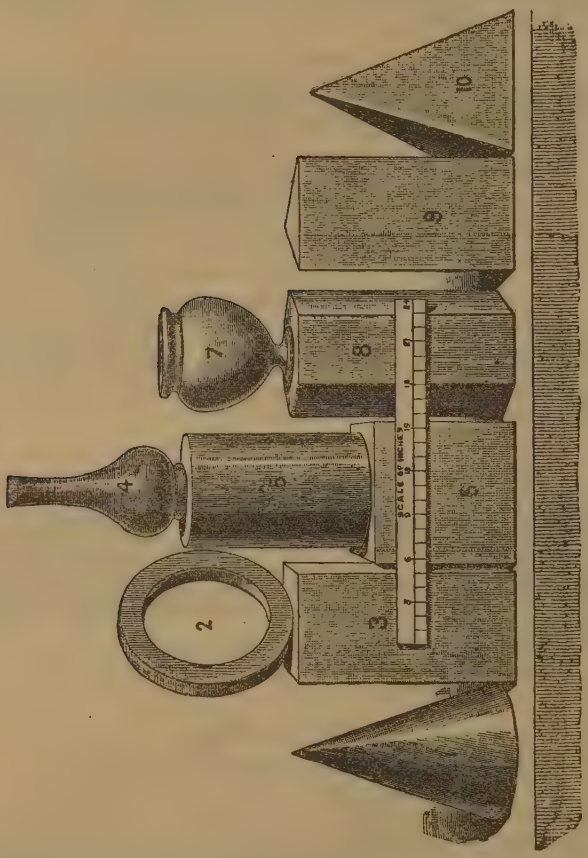

Fig. 1.

The drawing must fairly fill the quarter imperial sheet of drawing paper supplied to the candidate sitting for examination.

* These examinations nearly correspond with the former 2nd Grade Examinations in these subjects.

ADVANCED STAGE (SUBJECT 5A).

(2½ *hours are allowed for this Examination.*)

Candidates are required to make a shaded drawing from a group of three or more of the geometrical models and simple vases shown in Figs. 1 and 2.

The drawing must be made on a scale so that it shall fairly fill a half-sheet of imperial paper.

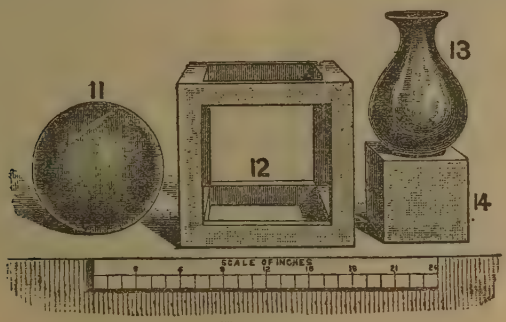

FIG. 2.

Drawing in Light and Shade from a Cast.

ELEMENTARY AND ADVANCED STAGES.

(SUBJECT 5B.)

ELEMENTARY STAGE.

(3 *hours are allowed for the Examination in this stage.*)

Candidates are required to make a shaded drawing from a cast of ornament similar to those shown below (*see* Figs. 1 to 5). But the Department will supply the examples for use at the Examination. The drawing must fairly fill a quarter imperial sheet of paper and must be slightly larger in size than the cast.

FIG. 1.

FIG. 2.

Fig. 3.

Fig. 4.

Fig. 5.

See N.B. on page 268.

Advanced Stage.

(*4 hours are allowed for the Examination in this stage.*)

Candidates are required to make a shaded drawing, which must be slightly enlarged, from a cast of fruit or foliage, or from a rosette, centre of a scroll, or other cast of ornament in high relief, similar to those shown below (*see* Figs. 6 to 8). But the Department will supply the examples for use at the examination. The drawing must fairly fill a half imperial sheet of drawing paper.

Fig. 6.

Fig. 7.

Fig. 8.

N.B.—In respect of both stages the casts selected for use should be hung before the candidates in such a way that each of them is lighted by only one light. The size of the casts should be in fair proportion to the size of the drawing paper upon which the candidate is required to do his work.

Perspective

AND SCIOGRAPHY.

In the examination questions the following terms will be used with the meanings here attached to them:—

Ground line.—The intersection of the ground plane with the picture.

Picture line.—The intersection of any plane (except the ground plane) with the picture.

Vanishing parallel of a given line.—A line drawn through the eye parallel to the given line.

Horizontal trace of a plane.—Its intersection with the ground plane.

Inclined plane.—A plane inclined to the ground plane and having its horizontal trace perpendicular to the ground line.

Ascending } plane.—A plane inclined to the ground plane, and having its
Descending } horizontal trace parallel to the ground line.

Oblique plane.—A plane inclined to the ground plane, and having its horizontal trace neither perpendicular nor parallel to the ground line.

Vanishing point of the inclination of a plane.—The vanishing point of a line in the plane at right angles to the horizontal trace of the plane.

Elementary Stage (Perspective only).

(Subject 1c.)

Candidates in the Elementary Stage must be prepared to solve problems in Section I., and to answer questions in Section II.

Section I. Candidates are required to represent in perspective from plan and elevation, or from specification, simple solids or objects of plane or curved surfaces having one line or surface on or parallel to the ground plane. This may be done either by the direct method or by the use of vanishing points. By the direct method is meant the deduction of a perspective view direct from the plan.*

Section II. Candidates will also be expected to answer some simple questions on the theory of perspective.

Advanced Stage (Perspective and Sciography).

(Subjects 1c and 1e.)

Candidates in the advanced stage must be prepared to solve problems and answer questions, one or more, in *each* of the following Sections:—I., II., and III.

Note.—In Sections I. and II. a knowledge will be required of vanishing lines of oblique planes, vanishing points of shadows, &c.

Section I. Problems such as are given in the Elementary Stage (Section 1.), but more difficult in character.

- Drawing and measuring lines inclined to the horizontal, and contained in vertical planes inclined to the picture plane.
- Figures or solids in perspective, some of whose leading constructive lines are horizontal, and the others contained in vertical planes at right angles to the horizontal lines, e.g., a cube with one edge horizontal and one face making a given angle with the ground.
- Solids having plane or curved surfaces in oblique positions, and all their constructive lines inclined to the ground. Such representations being limited to problems which can be solved by the treatment of an oblique plane and perpendiculars thereto.
- Reflections of such solids in plane mirrors, horizontal or vertical.
- Shadows of lines, surfaces and solids, rectilineal or curved, upon any specified planes and on surfaces of single curvature, by natural or artificial light.

Section II. Definition of theoretical terms in use;
Clear description of all the constructions employed;
Reasons underlying their employment.

Section III. By means of Orthographic Projection to define the shades on and shadows cast by—

- Simple solids (rectilineal or of single curvature) and combinations of such solids.
- Simple forms of architectural or mechanical details.
- Solids of double curvature, e.g., sphere, hollow sphere, vase, baluster and cup forms.
- Position of solids:
  - Axis parallel to one of the planes of projection.
  - Inclined in any position.
- Conditions of lighting:
  - Sunlight:
    - (*a.*) Rays represented in plan and elevation at 45°.
    - (*b.*) Rays in any specified direction.
  - Artificial light.

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* The requirements for the elementary stage in the *practice of perspective* will correspond, as nearly as may be, with those previously demanded for 2nd Grade Examinations.

Shadows received by—
Planes—(*a*) vertical or horizontal; (*b*) inclined*; (*c*) oblique (given by their traces).
Surfaces of single or double curvature in any position.

Historic Ornament.

SUBJECT 22D.)

Candidates sitting for a second class only will be required to answer questions relating to DECORATIVE ART applied to furniture and utensils.

Those sitting for a first class will have in addition to answer questions relating to ARCHITECTURAL ORNAMENT.

All answers (in respect of DECORATIVE ART as well as ARCHITECTURAL ORNAMENT) should be very fully supplemented by good sketches and drawings, and high marks will be given for good draughtsmanship.

1. PREHISTORIC architectural and other ornaments and cognate forms in use among savage tribes.

2. EGYPTIAN and ASSYRIAN columns and appendages, mouldings, surface sculpture, and painting applied to architecture. Sculpture on a colossal scale, metal work, jewellery, wood and ivory carvings, furniture, pottery, textiles, manual arts as shown in illustrated books, and actual specimens at the British Museum and South Kensington.

3. GREEK columns and appendages, mouldings, panels, acroteria, ETRUSCAN and GREEK sculpture of various periods, arms and armour, metal work, ivory and gold statuary, jewel work, pottery, gems and coins.

4. The same arts on a larger and more sumptuous scale under the ROMAN and GRECO-ROMAN artists, from the days of Greek independence to the age of Constantine.

5. BYZANTINE, ROMANESQUE, NORMAN architectural decorative details :— columns, capitals, &c., mouldings. Sculpture belonging to the same styles, mosaics, paintings, enamels, jewellery, engraved crystals and gems, coins, costume as seen in specimens in the British and South Kensington Museums and in illustrated books; the Byzantine influence on the decorative arts of southern and western Europe.

6. MEDIÆVAL architectural ornament, columns, capitals, mouldings, panels, spandrils, crestings, corbels, tabernacles, pinnacles, pendants, parapets, &c. Mediæval sculpture, painting, metal work, arms and armour, enamelling, tapestries, textiles, mosaics, goldsmith's work, wood and ivory carving from the 12th to the close of the 15th century.

7. REVIVAL of ancient learning in the 15th century, its influence on the architectural and sumptuary arts, on the decorative features of architecture, and on all sumptuary arts, including majolica, lace, leather work, and ornament in every kind of material.

8. EIGHTEENTH century. Discovery of Herculaneum and Pompeii, return to Greek and Roman forms and decoration.

9. Ornamental details of the ARCHITECTURE OF THE EAST: of PERSIA, JAPAN, and CHINA. The SARACENIC ARCHITECTURE of EGYPT, SYRIA, and SPAIN, and the Saracenic and other architecture of India.

10. ORIENTAL SUMPTUARY ART as originating from Persia, with some Byzantine traditions. Damascened and wrought metal work, pottery, painted and inlaid wares, textiles, &c. Figure and flower painting as elements of Persian decoration. Arabian art and the geometric character of its ornament. Skill of Indian craftsmen in the arts of Persia. Indian goldsmiths' work showing traces of Greek traditions.

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* An inclined plane is to be taken to mean such a plane as is represented in elevation by a single line, *i.e.*, its horizontal trace is perpendicular to the vertical plane of projection.

11. Chinese and Japanese Ornament. Jade and ivory carving, enamelling, porcelain, bronze casting on a colossal and on a minute scale; lac work, block printing, silk and cotton weaving practised from remote times in China and Japan.

Principles of Ornament.

ELEMENTARY AND ADVANCED STAGES.

(Subject 22.)

Note.—In order to prepare for this examination the student must acquaint himself with the geometrical figures composed of straight and of curved lines; with right-lined and curved figures, and the mixture of both that have been used to contain ornament in the shape of panels, frames, diapers, &c.; he must study the leaves, flowers, and fruit of those plants that have been employed for floral ornament, such as the honeysuckle, the ivy, the laurel, the bay, the vine, the acanthus, the single parsley, the oak, and the thistle; he must then compare the original with examples of its application as ornament to plain and curved surfaces; carefully observing what parts of the natural form have been employed, and what parts have been rejected to form conventional ornament by the Greek, Roman, Byzantine, and Renaissance masters, and endeavour to discover why part is used and part rejected.

The principles deduced from the observation of nature, and of good ornament, are called the laws of ornament, and are given in the accompanying syllabus.

It will be found on examination, that the parts of plants are set out on a geometrical basis, most easily seen in the section of stalks, buds, fruits, &c., and in the plans of flowers; the arrangement of the leaves and flowers on their stalks are also set out on a geometrical basis, though often obscured by the growth of the plant, and the overlapping of the leaves, and all good ornament is also set out in a similar way. The student should observe that in smooth edged leaves, convex on both edges, symmetry is rarely found, the central rib does not divide the leaf into two similar parts, but the effect is gained by balance; one edge is also more convex than the other, by which variety is gained. In trailing and creeping plants, the vine of the pumpkin may be instanced, twists often occur in the stalk, that exemplify the vigour of its growth, and this has been used by ornamentalists with good effect. The first opening of leaves and flowers from their buds, and the early growth of plants, particularly when they burst from a capsule, are characterised by vigour of growth, and attention should be paid to the use made of these in ornament.

Certain elegant and strikingly shaped flowers, such as those of the pumpkin, the Turk's-cap lily, and the parrot tulip have occasionally been used as centres or bosses among acanthus foliage, though in good ornament they are mostly made up of other elements.

When these flowers have been drawn, they should be compared with the flowers used in Roman and Renaissance work to learn how they have been treated, and the same comparison should be made as to the treatment of fruits growing on their stalks, and of tendrils.

To give interest and variety to floral ornament, insects, reptiles, fish, birds, and quadrupeds, human and mythical forms have been introduced, as well as the works of nature and of men; of the former, the sun, moon and stars, the sea, rivers, mountains, trees and shrubs have been most frequently used, the latter may be roughly grouped into buildings, ships and boats, furniture, arms, armour, and standards, musical instruments, utensils, festoons, and garlands, dresses, hangings, fringes, ribbons, &c.; not only must their appropriate introduction be studied, but their scale and treatment, when used as ornamental accessories.

The foregoing remarks have been mainly confined to decoration in the flat, but much ornament has been expressed by modelling, which may be in the

round, or in high or low relief; though the principles are the same, the effect of modelled work depends on the shade and shadows produced by the particular lighting, and on the heights and distances or the ornament from the eye. The fitness of ornament for its place has also to be considered. Theoretically there may be unfitness in flat ornament, but this unfitness is purely æsthetic. We can walk on a carpet however unfit the pattern may be for its place, but this may not be the case in relief ornament. We may be unable to walk with bare feet on the sharp edged pavement of a bath, to wield a sword whose hilt is carved in spikes, or to lift a flagon whose handle is too close to its body, or is prickly; there may be as well an inappropriateness to the mind in relief ornament which has to bear weight looking too weak for the purpose.

The advanced student must notice the good or bad effect of certain lines or masses on each ornamental composition; the study of the examples of the Greek honeysuckle cannot be too strongly recommended, and also the devices resorted to for giving due effect to ornament in certain positions and for certain purposes. Rigidity and simple repetition are best adapted to the important parts of monumental work, while greater flow and breadth may be given to less important parts and less important subjects. In the foliated capitals of large columns, far away from the eye, confusion and spottiness are mainly to be avoided. The grand capitals of antiquity are a treasury of instruction, and those who aspire to become masters cannot study them too deeply. The introduction of horizontal lines at regulated intervals in the panels of Roman and Renaissance pilasters should be studied, as they give the stability and repose needed in subjects with a preponderance of curves. The introduction of skulls, bones, and other ghastly things should be avoided, since we have ceased to sacrifice victims on our altars, there is no excuse for their introduction. Winged cupids, children, and animals are introduced to relieve the monotony of floral ornament and add other graces to it; these should be treated as part of the scheme of ornament and not overpower it.

Mediæval carving should also be studied, for if it be sometimes wanting in grace it is generally of a stonelike character and is admirably suited to catch sunlight by its angularity of execution and to show as ornament in dull weather by reason of its under-cutting or piercing.

Good draughtsmanship is indispensable for the explanation of ornament, the mere knowing the names and meaning of the laws, &c. without the power of illustration is of next to no use to the students. They are recommended during their rambles to sketch at once any suggestion that may attract their attention by its grace or power in vegetable or animal forms, or in existing ornament. Some of the most successful compositions of the great masters owed their origin to figures, groups, or incidents seen and sketched in their leisure hours, and these incidents were often so transitory that the leading features could only be noted by the merest scrawl.

Elementary Stage.

The subjects for examination will be:—

Those Forms composed of Right and Curved Lines that have been used for the ornamentation of floors and as inlays and borders, including drawings of their use, and these drawings must show as much of the floor, and border, or the combination of both as will explain the patterns and the contrast between the floor and border; also drawings and explanations of the geometrical forms used as separations between floral borders and floral centres.

Illustrations of the same forms, and those compounded of them when used as the boundaries of panels, medallions, and diapers, with sketches of good examples of the floral ornaments that have been used to fill them.

The Names of the Laws of Ornament and for its Composition from the syllabus, with illustrations of their occurrence in the vegetable kingdoms, and of their application in pieces, and in schemes of ornament, and also illustrations of ornament not conforming to these laws.

The Names of the Classes of Ornament, with illustrations of each from well-known examples.

The Names of the Styles of Ornament, with illustrations of each from well-known examples.

THE HARMONIC PROPORTIONING of the divisions of plane walls, floors, and ceilings, by means of panels, bands, borders, &c., and also of the borders of the panels to the whole area of the panel or to the height of the band.

THE FILLING OF SPACES by spotting, powdering, lining, striping, chequering, or diapering, &c., to contrast with floral forms on borders, &c.

THE ILLUSTRATION OF SIMPLE SOLIDS of square, oblong, triangular, or circular section, showing them harmoniously proportioned by means of painted lines, or of plain, raised, or sunk mouldings.

THE ILLUSTRATION OF BEAKERS, vases, flagons, cups, saucers, and plates, of boxes, caskets, chests, pedestals, tripods, &c., of elegant, common-place, and ugly forms.

ILLUSTRATIONS OF APPROPRIATE CARVED ENRICHMENTS for bands and variously curved mouldings.

ADVANCED STAGE.

This examination will include the Elementary course, but the candidates will be expected to show a more thorough acquaintance with the principles and practice, as well as better draughtsmanship.

The additional subjects candidates will be examined in are as follows :—

THE TREATMENT OF CARVED FOLIAGE in the round, in high, middle, and low reliefs, and in sunk or intaglio work.

THE TREATMENT OF THE LEAVES and floral ornament in large capitals of columns.

MONOGRAMS and CIPHERS.

THE TREATMENT OF ORNAMENT IN THE FLAT, AND IN RELIEF on curved surfaces, such as on vases, &c., and on vaults and domes.

THE TREATMENT OF ANIMALS IN CONJUNCTION WITH FLORAL ORNAMENT, including mythical animals, such as the chimæra, the griffin, the wyvern, the phœnix, the winged dragon, winged sea monsters, and winged horses both of the land and of the sea.

THE PROPER TREATMENT OF HUMAN FIGURES IN FLORAL ORNAMENT, and of mythical forms, such as winged figures, satyrs, centaurs, sphinxes, sirens, harpies, mermaids, martichores,* the human-headed serpent, &c.

UNDERCUT ORNAMENT such as is found in Byzantine capitals, and in Gothic mouldings, &c.

PIERCED AND OPEN WORK, when the unpierced face is flat, and when it is in relief, as in pierced marble balustrades, in pierced woodwork, in cast and wrought-iron railings, gates, &c., and in wooden lattice work similar to that of the Saracens.

THE EFFECT OF DIFFUSED LIGHTING and of lighting from various points on relief ornament.

The reduction in height of moulded profiles, &c.

The methods of compressing or enlarging ornament when a series of panels of the same height, but of different lengths, or of the same width, but of different heights have to be treated with the same scheme of ornament.

THE DIFFERENT TREATMENT OF WOOD, stone, and metal when in juxtaposition.

THE TREATMENT OF TROPHIES formed of arms, armour, and standards, of implements and utensils, and of natural or artificial products.

Attention is called to a device of the Byzantines for producing variety in flat carved ornament by causing parts of the ground to bulge out, which is susceptible of great improvement and extension.

THE TREATMENT OF ORNAMENTAL PANELS containing figures, buildings, hangings, trees, and landscape.

* The original martichore was a lion with a man's head and bust, but the word is applied to stags with men's and women's heads and busts.

PRINCIPLES OF ORNAMENT.

I.—*Definitions.*

Ornament is the application of beautiful forms or colours to enrich an object.

Direct transcripts from nature rarely become ornament.

Ornament has no independent existence.

Inappropriate enrichment is not ornament.

II.—*Methods of Expression.*

Modelled, relief, or sunk ornament, is defined in shape by light, shade, and shadow, and may also be treated with colour. Ornament on a flat surface is produced by lines or by flat tints of colour in juxta-position, or by the imitation in painting of relief or modelled work.

III.—*Elementary Forms.*

The geometrical forms with which ornament may be constructed, or which may be used for enclosing ornament are :—Straight lines and the rectilinear figures formed by their crossing or meeting in horizontal, vertical, and oblique directions, such as—

The stripe.	The diamond.
The triangle.	Polygons.
The square.	Network, &c.

Regular curved figures, closed or open, and forms made from the combination of these, such as—

The circle,	Waves,
The ellipse,	Meanders,
The parabola,	Scrolls,
The hyperbola,	Festoons,
The catenary,	Imbrication,
Spirals,	&c.

and by the conjunction of both as in diapers.

IV.—*Laws of Ornament and for its Composition.*

The laws that have been deduced from the observation of the forms of nature and of good ornament are :—

Proportion.	Stability.
Repetition.	Subordination.
Series.	Repose.
Variety.	Geometrical arrangement.
Contrast.	Growth.
Radiation.	Superposition.
Tangential junction.	Fitness.
Symmetry.	Unity.
Balance.	

The effect of certain ratios between the height and width of objects of regulated distances between lines, or the regulated widths of stripes and of the distances between them, of certain regulated alternations of roughness and smoothness, of ornament and plain surface, of voids and solids, is more agreeable to the eye than other ratios, distances, or alternations. Objects or patterns so set out are said to be in harmonic proportion.

V. *Division of Surface.*

Plane surfaces such as floors, walls and ceilings, may be divided into panels of various shapes, square, oblong, polygonal, circular, oval, &c. they may be wholly covered with network or diapers. They may be wholly banded or striped, or two or all of these methods may be combined.

Curved surfaces such as the soffits of vaults or domes may be treated in the same way, only the horizontal bands form rings, and in domes the vertical stripes are called ribs.

In the setting out of the panels, bands, or stripes, harmonic proportion should be sought, and the borders of panels or bands should be in harmonic proportion to the panels or bands.

VI. *Solids.*

Large solids are treated by the architect, small ones by the ornamentalist, the object is to make them fit for their use in accordance with the material they are to be made of, and then to give them beautiful proportion and outline, regard being had to their perspective effect, and this is particularly necessary in the case of triangular pieces. Each piece should have one part predominant, except where they are symmetrical on a central horizontal axis.

VII. *Variety of Surface.*

Sectional form is broadly divided into the flat, the convex, and the concave, and may be infinitely extended by the joining of these together in varying proportions and positions, and by differences in the curves; all entablatures, bases, and series of mouldings come under this head. Texture may be divided into the rough, the smooth, the polished, or the burnished, and may be infinitely extended by using them in conjunction in varying proportions, and with various sorts of roughness, as may be seen in the treatment of metal, marble, stone, wood, and leather work, and in woven stuffs.

VIII. *The Setting out of Ornament.*

All schemes of ornament should be set out on a geometrical basis.

As a rule floral ornament on the same plane should spring from one root or from two roots, one on each side of the centre. For superposed ornament on two planes the lower pattern should be small and form a ground for the upper one, which should be larger and stiffer, as in the text work of the Saracens; if a third plane is superposed a geometrical pattern is the best.

Ornament should be strictly confined to the spaces enclosed by the structural lines. The examples of plates where one pattern runs over the bottom bevel and edge are to be avoided. In the case of curved forms each ornament should be confined to such part of the curved surface as will not cause its distortion.

Where ornate friezes, bands or panels are used to ornament portions of one large surface the intervening parts should be plain or covered by simple forms in the shape of spotting, powdering, lining, striping, or matted work and should not distract attention from the main ornament. In certain cases this effect has been attained by making the ornament of the subsidiary parts in such low relief that it appears at a distance a mere roughening of the surface.

IX.—*Classes.*

A. *Mnemonic.*—Where writing is introduced, or where signs or natural objects are used to aid recollection.

B. *Symbolic.*—Where the thing represented is endowed with a meaning, as of a duty, a dignity, an office, an attribute, or the like; for example, the winged globe in Egyptian, the thyrsus, and certain animals and plants in classic, the fish, the vine, &c. in Christian ornament.

C. *Æsthetic.*—For the purpose of charming the eye without special regard to a mnemonic or symbolic purpose.

X.—*Styles.*

A. *Realistic or Natural.*—Where an actual or natural object is simply copied and applied.

B. *Conventional or Abstracted.*—Where only those forms and qualities are represented that fulfil the required end of ornament, as curves representative of growth or elegance in flowers and plants.

C. *Naturalistic.*—Forms not necessarily imitated from nature, but similar to those employed by nature in decorating the skins and feathers of animals.

Candidates for the Elementary Examination must give examples from this syllabus, supplemented, where necessary by an enlarged description from the books referred to, including examples of infractions of the laws, &c., and illustrate all their answers with the best sketches they can make.

Books to be Studied by all Candidates.

Owen Jones. Grammar of Ornament.
R. N. Wornum. Analysis of Ornament.
F. W. Moody. Lectures and Lessons on Art.
The Principles of Ornament, by James Ward, edited by Professor G. Aitchison, A.R.A. (Chapman and Hall, Henrietta Street, Covent Garden, W.C.)

In addition to the above, Candidates for the Second Course or Advanced Stage of this Examination should study—

"La Composition Decorative," by M. H. Mayeux (A. Quantin, 7 Rue Saint Benoit, Paris).

Architecture.

(Subject 1d.)

I.—The Orders Greek and Roman.

The word "order" as applied to architecture. Its meaning as a combination of a column and its usual superstructure, or entablature. This combination, almost the only means of producing architectural effect employed by the Greeks, and the chief feature of Roman architecture. The term order as possessing also a wider significance and extended to denote a style or manner in keeping with one of the varieties of column in use in classic times.

The Greeks' use of the orders Doric, Ionic, and Corinthian. The Romans' addition of two others, namely, Tuscan and Composite, so raising the number of orders to five.

Candidates are expected to make themselves familiar with the forms and general proportions of good examples of the orders—both Greek and Roman—so as to be able to draw them from memory with correctness, but it is not required that the dimensions of the minute subdivisions of height and projection which are met with in the books on the subject should be committed to memory.

II.—Mouldings made use of with each order; the capital considered as the index to each; the enrichments applied to the various mouldings; and the ornaments customarily made use of.

Candidates must be prepared to draw some of these from memory.

III.—Sources from which the orders were derived. Rudimentary and somewhat archaic forms in which they appear in early Greek work. The mode in which they were employed by Greek architects and by the Romans, including the way in which the latter combined arches with columns, and employed pedestals, thus variously extending the scope of the orders. The use made of the orders by Renaissance architects and the variations introduced.

From the first the attention of the student should be directed to the points of distinction as well as of resemblance between the Greek and Roman orders, extending to the mouldings, enrichments, and ornaments, as well as the leading forms and proportions; and to the wide difference in architectural character thus created.

IV.—General Knowledge. Terms in ordinary use in architectural books.

Candidates will be required to illustrate their answers under this head by sketches.

V.—Buildings of architectural character—Renaissance, Mediæval, or Modern.

Candidates will be required to answer questions about buildings with which they are familiar, and the styles in which they are built, and will be asked to draw them or parts of them from memory.

Candidates cannot be too strongly impressed that architecture consists of buildings, not of representations of them; and that making studies of good specimens of architecture from buildings, or in the case of ornaments, &c. from casts, is the best way of obtaining proficiency in architecture. Such studies are often more instructive if drawn geometrically and to scale than if attempted in perspective.

Accuracy, combined with freedom, in draughtsmanship will always be taken into account in adjudging marks, and a thorough appreciation of the character of any object represented is of equal importance with the exact reproduction of the main proportions and prominent forms.

Candidates desiring to obtain a second class must be prepared to draw from memory, to scale, and with fair correctness, any of the orders Greek or Roman; and to a larger scale, portions of the mouldings, enrichments, capitals, or other features; and to answer questions on the architectural terms in general use.

Candidates desiring to obtain a first class must be able to do the work indicated above as required for the second class but with more precision and completeness; they must also be prepared in some of the other branches of study indicated above, though not necessarily in all of them; and their draughtsmanship must be of good quality.

Architectural Design.

(Subject 23b.)

Candidates will be required to design a building, or some portion of a building, in conformity with a statement of requirements, or upon a sketch plan, furnished to them, and to carry out its architectural treatment in some definite style.

The object of the examinations is to show that the candidate possesses a competent knowledge of the decorative features and ornaments employed in some one style of Architecture, such as Classic, Renaissance,

GOTHIC, &c., and the ability to use them. Any style to which the above description will apply may be selected.

1. In PLANNING a building, or in REVISING THE PLAN of one, the MASSES must be thrown into such a shape as will admit of a satisfactory TREATMENT OF THE EXTERIOR: and both the PLAN and SECTION must secure that the INTERIOR (or each part of it if it be cut up into halls or rooms, &c.) be of GOOD PROPORTIONS and capable of satisfactory DECORATION.

Attention to these conditions must be combined with due attention to carrying out the statement of requirements, and to arranging for good access, lighting, and general convenience.

2. A good BALANCE of openings and solids and good PROPORTIONS are essential to a successful DESIGN; and when the general lines have been settled, appropriate ARCHITECTURAL DECORATION must be added. This does not simply mean ornament, it implies a familiarity with and the ability properly to introduce all that goes to make up ARCHITECTURE.

For example, in a CLASSIC DESIGN the candidate must be able to introduce suitable RUSTICATION, the ORDERS, possibly a DOME, and the usual TREATMENT OF OPENINGS, CORNICES, BALUSTRADES, PANELS, &c., with their appropriate MOULDINGS, ENRICHMENTS, and ORNAMENTS.

If the style be GOTHIC the candidate must show that he is familiar with, and can correctly employ, ARCHES, BUTTRESSES, VAULTS, HIGH ROOFS, DORMERS, TRACERY, CARVING, &c., such as were in use at the period which he selects.

Sufficient and correct knowledge of at least one style; draughtsmanship which while exact and true shall yet be free and spirited; and a little skill in the putting together of the parts of a design, such as is best acquired by practice and by study of existing buildings of good architecture, are the qualifications essential to success in this examination. The degree in which these qualifications are shown in the design will determine what award shall be made for the candidate's work.

Anatomy.

(SUBJECT 9.)

The examination questions in this subject will be given with the object of testing the candidates' knowledge of certain truths which every representation of the human figure must embody, or be wrong.

Candidates will be required to illustrate their answers as fully as possible with good sketches, for which higher credit will be given than for elaborately written descriptions.

The following statement includes the more important subjects which should be studied.

The ESSENTIAL AND DISTINCTIVE CHARACTERS OF THE HUMAN FORM. The divisions and regions of the body.

The PROPORTIONS of the normal adult male and female; the wholly different proportions of the infant; and the metamorphosis of the infantile into the adult form in consequence of the different modes of growth of the head, trunk, and limbs.

The STATIONARY FIGURE.—The causes of the reliefs of the surface of the skin mainly to be sought in the subjacent structures—bone, muscle, tendon, fat, and glands. Elementary exposition of the nature of these structures.

The FIGURE IN MOTION.—The modification of reliefs consequent, directly or indirectly, on changes of the form of muscles. Elementary exposition of the effects of contraction on the form of muscles. Experimental demonstration on

the muscles of a frog's leg. Illustrations on living model, *e.g.*, changes of relief in the upper arm and in the calf of the leg in consequence of the contraction of biceps and gastrocnœmius.

The SKELETON as the framework of the body. The spinal column, with its ligaments, as a whole; its curves: the range of motion of its parts. The skeleton of the thorax as a whole. The range of motion of the ribs and the sternum. The fixation of the spinal column into the pelvis. The inclination of the sacrum and of the plane of the brim of the pelvis to the vertical axis of the body. The differences in the proportions of the pelvis in the sexes.

The connexion of the skull with the spinal column and its consequent possibilities of motion. The calvaria and the face; broad and long, high and low skulls; prognathism and orthognathism; varieties of the malar region, and in the form of the orbits and lower jaw; the chin prominence. Different characters of the skull and face in men, women, and children.

The skeleton of the upper limb. The normal position of the shoulder blade and the surface reliefs to which it gives rise. The forms of the articulations as influencing reliefs and limiting the extent and the character of the movements of the parts of the limb on one another, with especial reference to pronation and supination of the hand and the possible positions and movements of the thumb and fingers.

The haunch-bone as a determinant of form. The skeleton of the lower limb treated in the same way as that of the upper limb. The tarsus (as a whole) and the setting on of the toes.

The MUSCLES, so far as they determine the outward form of the body. The muscular constitution of the walls of the abdomen; the changes consequent upon various attitudes. The muscular masses of the back and neck. The larynx, so far as it affects the form of the throat.

The superficial muscles of the limbs. The anatomical reasons for the reliefs and depressions of the skin of the hand and foot. The normal hand, with the proportions and possible positions of the digits. The nails and the distribution of hair on the hand. The area of contact of the sole of the foot with the surface in standing. The "arch" of the foot. The normal proportions and the relative positions of the toes.

The brow, eyelids, and visible parts of the eyeball. The nose, lips, and chin. The parts of the externally visible ear. The muscles of the jaws. The relations of the skin of the face to the subjacent parts at different periods of life.

The positions of the parts of the face which constitute the various forms of expression. The general arrangement of the muscles, the contraction of which brings about these positions.

Design.

ELEMENTARY STAGE.

(SUBJECT 23c.)

Surface decoration.

I. Candidates for examination will have to make designs to fit given spaces, such as a square, a triangle, a circle, a spandril, a lunette, a pilaster, a panel, &c., &c.

Such designs may consist of:—

A. Ornament composed of straight lines only.
B. Geometric ornament (not confined to straight lines).
C. Interlacing ornament (not strictly geometric).
D. Scroll-work.
E. Foliated or floral ornament.

Repeated pattern.

II. Candidates will have further to design repeating patterns :—
A. Straight lined,
B. Geometric,
C. Interlacing,
D. Of scroll-work,
E. Foliated or floral,

and to design them on given lines. That is to say, they may be called upon to make their design a "sprig" pattern, for example, or a "trellis", or to set it out on the lines of the square, of the parallelogram, of the hexagon, of the diamond; or they may be asked to design it as a "drop." (Consult "Anatomy of Pattern," by Lewis F. Day. Batsford.)

Again, the pattern may be for a border, straight-lined, geometric, or what not (A, B, C, D, E); or for some particular kind of border, vertical, for example, or horizontal, or in the nature of a frame with corner; or, yet again, the border may be more precisely defined, as a fret, for example, a wave, a border in compartments, or one broken by rosettes or pateræ, and so on.

The manner of drawing.

III. Drawings, whether for school exercise or for examination, should be not in pencil merely, nor in outline, but in water colour; and the design should be washed in to show dark against the ground, or the ground washed in leaving the design light upon it, with or without an outline. The design may be in black and white or in two tints of colour (not more). In the latter case the two colours should be harmonious or in pleasing contrast. The colouring need not be absolutely flat; but there should be no shading, nor any attempt at relief; it should define the design and not confuse it. The drawing should be neither vague nor sketchy, but clean and precise.

Note.—It is not thought necessary to insist, at this elementary stage of instruction, upon the adaptation of designs to execution in any specific material or by any specific process; but the teacher is reminded that the pupil cannot too early have impressed upon him the necessity of considering, in every design he makes, the use or purpose to which it could practically be put.

Advanced Stage.

(Subject 23c.)

Historic style.

I. Candidates for examination must not only have studied the Historic Styles of Ornament, but must be able to make a design for a border, for example, a diaper, a panel, &c.) in the Greek, Roman, Early Gothic (13th century), Renaissance (Cinque Cento), or Moresque manner.

Note.—Such studies will inevitably be more or less in the nature of reminiscences, but teachers should see that they are not reproductions of any existing examples; they should encourage the student to give full play to his own invention, so long as what he does would not appear incongruous or out of keeping with work of the period given. (Consult "Analysis of Ornament," by R. N. Wornum. Chapman and Hall.)

Conventional treatment.

II.—Candidates must have had practice in making designs for panels, pilasters, friezes, borders, spandrils, &c. in which some well-known plant (selected for them) has been taken as a starting point.

Such designs should in every case be adapted to some specific purpose, and to some specific method of execution; and teachers are recommended to insist upon the mention of such purpose and method, in writing, on the margin of the drawing, in order that they may see that the student had a reason, and what reason he had, for the particular kind of convention adopted.

Note.—Here again the study of Historic Ornament will best help to explain what conventional treatment should be;—not that the student will there find natural forms ready adapted for his use, but that he will see how the ancient, mediæval, or oriental workman modified natural form to suit his ideas of ornament. (Consult "Nature in Ornament," by Lewis F. Day. Batsford).

Applied design.

III. Candidates should be generally acquainted with the various simple processes of workmanship, such as stencilling, colour printing, inlaying, wood

carving, modelling, casting, &c., so as to be able to make a design which is practically adapted to execution in a given material or by a given method.

(Consult "Application of Ornament," by Lewis F. Day. Batsford.)

Note.—Teachers should see that the student is never allowed to make a design without a very clear notion as to how, from beginning to end, it could be carried out. There is more to be learnt from making a simple design well suited to its purpose than from elaborating the most ambitious drawing adapted to no purpose or process of execution.

Original design.

IV. For the Examination candidates will be called upon to make, not merely designs in a given style (as in paragraph I.), or on the basis of a given plant (as in paragraph II), but original designs adapted to some specific purpose.

They may be asked, for example, to make a design for some particular object, for a pavement, perhaps, a ceiling or a frieze, a book cover, a vase, a fan, or what not.

Or they may be asked to make a design adapted to some special process of execution, for inlaying, for process printing, for weaving or embroidery, for embossing, modelling, and so on.

The manner of drawing.

They will have to execute their designs in water-colour; a drawing in pencil or in outline merely will not do. Even though the design be in black and white, it must be washed in, to show light on dark or dark on light, as the case may be.

When the design is for something in relief, the shading must be such as to explain the design, rather than to give the effect of actual modelling: it is a question of design, not of painting.

In the matter of colour there is no restriction, further than what the material or the purpose of the design may suggest; but, as in the case of shading, the colour should not be made use of to obscure the form but to help it.

Scale of drawings.

V. Designs done as school practice as well as those for examination should be drawn, if possible, to the full size of execution; or at least they should be drawn to scale (to be figured, of course, on the drawing), and to a scale large enough to show the detail of the design; a mere *scheme* on a very small scale is not enough.

Where, as in the case of a design for a pavement, full-size detail is out of the question, it will be necessary to make a small sketch-plan of the whole and to draw a portion of the detail to large scale.

Drawings should, in fact, be as nearly as possible such as could be put into the hands of a workman to carry out.

Scope.

VI. It is not expected that designs in this stage should in any case include the human or animal figure; but, if introduced, such figures must conform strictly to ornamental considerations.

Honours.

(Subject 23d.)

Subject.

I. Candidates for honours will have to submit either:—

(A.) A scheme of decoration, with some one important feature of it drawn to full size, or to as large a scale as the paper supplied will allow; or

(B.) A panel or other important composition, drawn to full size, or to as large a scale as the paper supplied will allow, with a sketch showing the position it is meant to occupy.

Note.—It is assumed, of course, that Candidates for Honours are competent to pass, or have passed, the examination in the Advanced Stage, Subject 23c.

Adaptation.

II. The design must be adapted to some specific method of execution, such as painting (in distemper, &c.), carving (in wood, &c.), engraving, glass painting, chromo-lithography, &c.; and it must be stated, in writing, on the drawing what that method is.

Figure, &c.

III. The design must include either (1) the human figure, or (2) animal forms, or (3) some ornamental feature important enough to occupy a central position in a scheme of decoration.

Note.—A *Scheme* of decoration need not of necessity have any relation to architecture: almost any design too comprehensive to be carried out in its entirety in the time allowed for the examination would answer to the term—provided that it were all sketched in, and some important part of it were properly finished.

Manner of drawing.

IV. Drawings may be either in water-colour or in ink; that is to say, they must be executed, either with the brush or with the pen, and must not be merely in pencil.

N.B.—Candidates who fail to conform in any way to the conditions plainly laid down, will forfeit all chance of passing the examination, in whatever stage.

Painting Ornament in Monochrome.

(Subject 11a.)

The exercises have to be executed on the specially coloured canvases supplied by the Department, the form, light, and shade, must be taken from a diagram which is issued as a confidential examination paper. The ornament must be painted in what is known as "Grisaille," and should be in agreeable relation with the colour of the ground, and not necessarily, therefore, made only of black and white.

Candidates may paint in oil or tempera only.

The coloured canvases to be used by candidates desiring to paint in tempera must be previously coated with size, and must be thoroughly dry before being given to candidates. Neither teacher nor candidates are allowed to prepare these canvases for tempera painting. The canvases must be treated by those in charge of the examination as confidential materials.

Candidates will be expected to sketch in the whole of the ornament, and finish as much as they can of it.

Painting from Still Life.

(Subject 15.)

Candidates are required to paint in colour a group of still-life objects, such as:—

A pewter inkstand filled with ink, a quill pen standing in it, another quill pen lying on a sheet of red blotting-paper which has been in use; or a plate with two or three oranges in it; and such like groups of objects.

The exercises must be executed on the canvases supplied by the Department.

Candidates may paint in oil or water colours.

Candidates using water colours must strain such paper as they are accustomed to use over the canvas, writing on their paper the examination number which is upon the slip fastened to the canvas. In order that they may do this, the canvas may be supplied to them before the time fixed for examination.

The directions for selecting the objects for the group must be treated by the superintendents of examination as confidential. The superintendents must have the objects arranged according to the instructions. This arrangement should be completed not more than half an hour before the time fixed for the commencement of the examination.

Drawing from the Antique.

(SUBJECT 8B2.)

(*The examination in this subject may be held only in schools provided at least with four full-sized figures.*)

Candidates are required to draw from the cast of such a figure as that of the Venus of Milo, the Gladiator, the Antinous, or the Discobolus, in any point of view which may be selected by the examiner.

The casts have to be arranged by the superintendents of examination before the candidates arrive.

Candidates' drawings may be executed in chalk or black lead pencil, at least 15 and not more than 18 inches in height, and on a half imperial sheet of drawing paper supplied by the Department.

Candidates are required to place a mark on the right hand of the drawing paper showing the height of the "horizontal line" (to indicate the level of the candidate's eye).

Drawing the Antique from Memory.

(SUBJECT 8F.)

Candidates are required to draw from memory any one of the following figures in any point of view which may be selected by the examiner:—

The Standing Discobolus,
The Germanicus,
The Antinous, and
The Dancing Faun.

Candidates' drawings must be in outline at least 15 and not more than 18 inches in height, and may be executed in chalk or black lead pencil on a half imperial sheet of drawing paper supplied by the Department.

Shading is not expected, but proper indications of the more striking forms within the contour may be given, and marks will be allowed for them.

Drawing from Life.

(SUBJECT 8C2.)

Candidates are required to draw from a nude male figure,* which has to be posed according to the confidential instructions issued to the superintendent of examination.

The studies must be executed in chalk or black lead pencil, on a half imperial sheet of drawing paper supplied by the Department, and must be at least 15 and not more than 18 inches in height.

Candidates are required to place a mark on the right hand of the drawing paper showing the height of the "horizontal line" (to indicate the level of the candidate's eye).

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* Where women candidates are to be examined a female model should be posed in the same attitude.

Modelling from the Cast.

(ELEMENTARY STAGE ONLY.*)

(SUBJECT 18A.)

Candidates are required to model from one or other of the following examples :—

No. 344. Rosette from the Capitol, Rome.
„ 345. Another ditto.
„ 346. Another from the Cloisters of St. Maria del Popolo, Rome.
„ 2315. Ten Elementary Studies of Ornament.
„ 494*a*. Small Rosette from the Tomb of the Scipios.
„ 494*b*. Another ditto.
„ 1542*e*. Pilaster from Tomb of Louis XII.
„ 1543*e*. Another ditto.
„ 476*a*. Another ditto.
„ 476*b*. Another ditto.
„ 478. Madeleine Pilaster (or section of it).
„ 1641. Small Carved Panel, Tracery—Gothic.

The above reference Nos. are quoted from the list Nos. 30A and 34 (Lists of Casts) formerly issued from the Department. Copies of the Casts are exhibited at the South Kensington Museum.

The following three examinations† take place under the superintendence of Local Committees, &c. about May.

Modelling from Life.

(SUBJECT 19H.)

Candidates are required to model a nude figure‡ in relief upon a panel about 24 inches by 14 inches.

Modelling from the Antique.

(SUBJECT 19I.)

Candidates are required to model upon a panel about 13 inches by 9 inches, the subject of the examination, smaller than the original placed before them.

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* This nearly corresponds with the former 2nd Grade Examinations in Modelling.
† These examinations are held at local centres where candidates themselves are prepared to cast their own models.
‡ Where women candidates are to be examined a female model should be posed in the same attitude.

Modelling Design.

Elementary Stage.

(Subject 23e.)

I. Candidates for examination will have to model designs in relief—not a the round—to fit given spaces, such as a square, a triangle, a circle, a spandril, a lunette, a pilaster, a panel, &c. &c. Surface decoration.

Such designs may consist of :—

A. Ornament composed of straight lines only.
B. Geometric ornament (not confined to straight lines).
C. Interlacing ornament (not strictly geometric).
D. Scroll-work.
E. Foliated or floral ornament.

II. Candidates will have further to design repeating patterns :— Repeated pattern.

A. Straight lined,
B. Geometric,
C. Interlacing,
D. Of scroll-work,
E. Foliated or floral,

and to design them on given lines. That is to say, they may be called upon to make their design a "sprig" pattern for example, or a "trellis"; or to set it out on the lines of the square, of the parallelogram, of the hexagon, of the diamond; or they may be asked to design it as a "drop." (Consult "Anatomy of Pattern," by Lewis F. Day. Batsford.)

Again, the pattern may be for a border, straight-lined, geometric, or what not (A, B, C, D, E,); or for some particular kind of border, vertical, for example, or horizontal, or in the nature of a frame with corner; or, yet again, the border may be more precisely defined, as a fret, for example, a wave, a border in compartments, or one broken by rosettes or pateræ, and so on.

III. Models, whether for school exercise or for examination, should be in relief. The design should be well defined, that is to say, the modelling should be neither loose nor sketchy, but clean and precise. The manner of modelling.

Note.—It is not thought necessary to insist, at this elementary stage of instruction, upon the adaptation of designs to execution in any specific material or by any specific process: but the teacher is reminded that the pupil cannot too early have impressed upon him the necessity of considering, in every design he makes, the use or purpose to which it could practically be put.

Advanced Stage.

(Subject 23e.)

I. Candidates for examination must not only have studied the Historic Styles of Ornament, but must be able to make a design (for example, moulding, frieze, capital, a diaper, a panel, &c.) in the Greek, Roman, Early Gothic (13th century), Renaissance (Cinque Cento), or Moresque manner. Historic style.

Note.—Such studies will inevitably be more or less in the nature of reminiscences, but teachers should see they are not reproductions of any existing examples; they should encourage the student to give full play to his own invention, so long as what he does would not appear incongruous or out of keeping with work of the period given. (Consult "Analysis of Ornament," by R. N. Wornum. Chapman and Hall.)

II. Candidates must have had practice in making designs for panels, capitals, pilasters, friezes, borders, spandrils, &c. in which some well-known plant (selected for them) has been taken as a starting point. Conventional treatment.

Such designs should in every case be adapted to some specific purpose, and to some specific method of execution; and teachers are recommended to

insist upon the mention by the students of such purpose and method, in writing, in order that they may see that the student had a reason, and what reason he had, for the particular kind of convention adopted.

Note.—Here again the study of Historic Ornament will best help to explain what conventional treatment should be;—not that the student will there find natural forms ready adapted for his use, but that he will see how the ancient, mediæval, or oriental workman modified natural form to suit his ideas of ornament. (Consult "Nature in Ornament," by Lewis F. Day. Batsford.)

Applied design.

III. Candidates should be generally acquainted with the various simple processes of workmanship, wood, stone, and ivory carving, &c., metal working casting, &c. so as to be able to make a design which is practically adapted to execution in a given material or by a given method.

(Consult "Application of Ornament," by Lewis F. Day. Batsford.)

Note.—Teachers should see that the student is never allowed to make a design without a very clear notion as to how, from beginning to end, it could be carried out. There is more to be learnt from making a simple design well suited to its purpose than from elaborately modelling an intricate scheme of ornament adapted to no purpose or process of execution.

Original design.

IV.—For the examination candidates will be called upon to make, not merely designs in a given style (as in paragraph I.), or on the basis of a given plant (as in paragraph II.), but original designs adapted to some specific purpose.

They may be asked, for example, to make a design for some particular object, for a ceiling, a frieze, a capital, a vase, a casket, or what not.

Or they may be asked to make a design adapted to some special process of execution, for wood-carving, goldsmiths' work, casting (by the wax or other process), embossing, and so on.

They may have to execute their designs in the round or in relief.

Scale of models.

V. Designs done as school practice as well as those for examination should be modelled, if possible, to the full size of execution; or at least they should be modelled to scale (to be figured, of course, on the model), and to a scale large enough to show the detail of the design; a mere *scheme* on a very small scale is not enough.

Where, as in the case of a design for a ceiling, full-size detail is out of the question, it will be necessary to draw a small sketch-plan on paper of the whole and to model a portion of the detail to large scale.

Models should, in fact, be as nearly as possible such as could be put into the hands of a workman to carry out.

Scope.

VI. It is not expected that designs in this stage should in any case include the human or animal figure; but, if introduced, such figures must conform strictly to ornamental considerations.

Honours.

(Subject 23f.)

Subject.

I. Candidates for honours will have to submit either:—

(A.) A scheme of decoration, with some one important feature of it modelled to full size, or to as large a scale as the limits of size (36 in. high × 24 in. wide) will allow; or

(B.) A panel or other important composition, modelled to full size, or to as large a scale as the above dimensions will allow, with a sketch on paper showing the position the panel or important composition is meant to occupy.

Note.—It is assumed, of course, that Candidates for Honours are competent to pass, or have passed, the examination in the Advanced Stage, Subject 23e.

II. The design must be adapted to some specific method of execution, such as carving in stone or wood, casting, stamping, hammering, or chasing in metal, and it must be specified on the model what that method is. Adaptation.

III. The design must include either (1) the human figure, or (2) animal forms, or (3) monsters forming some ornamental feature important enough to occupy a central position in a scheme of decoration. Figure, &c.

Note.—A *Scheme* of decoration need not of necessity have any relation to architecture: almost any design too comprehensive to be carried out in its entirety in the time allowed for the examination would answer to the term—provided that it were all sketched in, and some important part of it were properly finished.

IV. Models may be required either in the round or in relief as the examiner may prescribe. Manner of modelling.

N.B.—Candidates who fail to conform in any way to the conditions plainly laid down, will forfeit all chance of passing the examination, in whatever stage.

Additional Art Master's Certificates.

(Groups II., III., IV., V., and VI.)

In addition to the Art Master's Certificate, Group I., the following Certificates for different groups of subjects of instruction in Art are also granted to candidates who pass the prescribed examinations:—

Certificate for Group II.—(Painting, Drawing, and Design.)

Second Group.

This Certificate is granted to candidates who have obtained a Certificate of the First Group, and who have submitted satisfactory specimens of the following works:—

(*a.*) Subject 8*b*[2]. A Shaded drawing of a complete figure from the Antique. (On an imperial sheet.)

(*b.*) „ 8*d*. A Study of Drapery arranged on an Antique figure. (On an imperial sheet.)

(*c.*) „ 11, 12, or 23. A Decorative Painting in Monochrome of Ornament in grisaille on a coloured ground in oil colour or tempera. The form and light and shade may be taken from a cast or from a photograph or drawing, or may be designed. (On a sheet or canvas 30 in. by 7 in.)

The colour of the ground may be chosen by the student, and that of the ornament, which should be what is known as "Grisaille," though not necessarily made only of black and white, should be in agreeable relation with the colour of the ground.

(*d.*) „ 15*b*. An imperial sheet with a Group of Flowers painted from Nature in water-colour. It is desired that this shall be, as far as possible, a composition of flowers or flowering plants painted with proper relation to a real background, and arranged as a composition of colour.

(*e.*) „ 22*d*. *A set of fifteen studies of Ornamental Design, showing the treatment of diapers, friezes, borders, panels, pilasters, &c., from original examples in colour or relief; either in the South Kensington Museum or elsewhere. The date, style, and local origin of the example must be given on each sketch, and the series should analytically illustrate modifications evolved during various periods.* (*On two imperial sheets.*)

These studies should be coloured and shaded sufficiently to exhibit the treatment and modifications, and should not be highly finished specimens of still-life painting.

Sections should be given of those parts of relief ornament which can be easily shown in that way, such as mouldings, and in the representation of embroidery the direction of the stitching should be given.

Students in country schools may make their studies from works on Architecture or Ornamental Art, and should supplement them as far as possible from examples in local Museums and in churches or houses in the neighbourhood.

(*g.*) Subject 23*c*. *A Drawing of a Flowering Plant (such as that drawn in* (*f*) *for Group I., page* 65), *with three distinctly different designs for patterns based on the plant. Each of these three different designs must be suited to the technical requirements of one of three different processes of manufacture; such, for instance, as embroidery, inlay, printing, wrought metal, weaving, paint-*

ing, &c. The process and material for which it is intended must be named on each design. One, at least, of these designs must be executed in body colour or tempera. (On an imperial sheet.)

and have passed "Good" or obtain a first class at the Art Examinations in—

(*h.*) Principles of Ornament (Advanced Stage).
(*i.*) Design (Advanced Stage).
(*k.*) Painting Ornament in Monochrome from a sketch or photograph as an exercise in decorative painting. (*See* (*c*) Subjects 12 and 23 above.)
(*l.*) Drawing in chalk from an Antique figure.

CERTIFICATE FOR GROUP III.—(DRAWING AND PAINTING THE FIGURE AND STILL-LIFE.)

This Certificate is granted to candidates who have obtained Certificates of the First and Second Groups, and who have submitted satisfactory specimens of the following works:— Third Group.

(*a.*) Subject 8*c*[2]. A shaded drawing of a complete figure from the Life. (On an imperial sheet).

(*b.*) „ 8[d]. Two studies of Drapery arranged on the Living model; the drawing of each figure to be not less than 12 inches in height. (The studies to be mounted on one imperial sheet).

(*c.*) „ 9*a*. *Two drawings in outline of the same Antique figure or living model, or of one of two photographs from nude figures by M. Angelo in the Sistine Chapel; within one outline the bones of the figure are to be indicated, and within the other the muscles. (On two imperial sheets.)*

(*d.*) „ 15*a*. A study of a Group of Still Life or flowers, as a composition of colour, in oil. (On a canvas 20″ × 24″.)

(*e.*) „ 17*c*. A painting in oil-colour of the Nude Figure from the life. For female candidates the figure may be partially draped, but the hands and feet must be exposed. (On a canvas not exceeding 36 inches in its longer dimension.)

(*f.*) „ 22*d*. Varied studies of Historic styles of Ornament, sufficiently extensive to represent the history of the styles selected, sketched from works in the South Kensington Museum, THE AUTHORITY IN EACH CASE BEING GIVEN. If they are from coloured ornament, the sketches are to be coloured also. Studies of figures without the architectural or ornamental surroundings with which they are combined are not desirable. (*See also* directions under Group II.) (On two imperial sheets.)

(*g.*) „ 23*d*. *A design, drawn or painted, of Ornament and Human Figures as applied to decorative or industrial Art. This design should be not less than 15 inches in its longest direction. It is essential that human figure should form an important feature of the ornament designed. (Of imperial size.)*

and have passed "Good" or have obtained a first class at the Art Examinations in—

(*i.*) Anatomy of the Human Figure.
(*k.*) Historic Ornament.
(*l.*) Painting in colour a Group of still life (Subject 15*a* or 15*b*). Any medium or vehicle may be required in the regulations for the Examinations.
(*m.*) Drawing in chalk from the Life.
(*n.*) Design (Honours Stage).
(*o.*) Drawing the Antique from memory.

Candidates who are, or have been, students of the Royal Academy, and there admitted to study from the living model, are not required to pass the examination in drawing from the living model.

Certificate for Group IV.—(Modelling Ornament and the Figure.)

Fourth Group.

This Certificate is granted to candidates who have obtained the Art Class Teacher's or Intermediate Certificate, and who have submitted satisfactory specimens of the following works:—

(*a.*) Subject 8*b*². A shaded drawing of a complete figure from the Antique. (On an imperial sheet.)

This will not be required of a candidate who has taken the certificate for Group II.

(*b.*) Subject 18*b*. Modelled study of Ornament from the cast. (On a panel 18″ × 24″.)

(*c.*) „ 18*c*. Modelled study of Ornament from a drawing or photograph. (On a panel 18″ × 24″.)

(*d.*) „ 19*b*² (two works). A model of an Antique figure, not less than 30 inches high, in the round to be cast by the candidate, and another of like dimensions in relief.

(*e.*) „ 20. Flowers or Foliage, modelled suitably for sculptural treatment, and arranged ornamentally. (On a panel 18″ × 24″.)

(*f.*) „ 22*d*. A set of studies executed in Outline showing the treatment of Arabesques, &c., as in Group II. (On an imperial sheet.)

This will not be required of a candidate who has taken the certificate for Group II.

(*g.*) Subject 23*e*. Modelled ornament designed in similar character to that under 23*c* in Group II. (The four works arranged on a panel 18″ × 24″.)

and have passed "Good" or obtained a first class at the Art Examinations in—

(*h.*) Principles of Ornament (Elementary Stage).

This will not be required of a candidate who has taken the certificate for Groups I. or II.

(*i.*) Modelling, Design (Advanced Stage).

(*k.*) Modelling from the Antique.

Certificate for Group V.—(Modelling the Figure from Life.)

Fifth Group.

This Certificate is granted to candidates who have obtained a Certificate of the First and Fourth Groups, and who have submitted satisfactory specimens of the following works:—

(*a.*) Subject 19*e*. A Modelled study, not less than 30″ high, from the Life.

(*b.*) „ 8*c*². A shaded drawing of a complete figure from the Life. (On an imperial sheet.)

Candidates who have taken the certificate for Group III., and those who are, or have been, Students of the Royal Academy, and there admitted to study from the living model, are not required to pass the examination in drawing from the living model.

(*c.*) Subject 9*a*. A Drawing of the Skeleton placed within the outline of an Antique figure. (On an imperial sheet.)

This will not be required of a candidate who has taken the certificate for Group III.

(*d.*) Subject 9*c*. An Anatomical rendering of an Antique figure, Modelled. (On a panel not less than 30 inches high.)

This work accepted for Group V. Certificate will also count instead of the drawing of the muscles for Group III. Certificate.

(*e.*) Subject 22*d*. (*a.*) Drawings of the Relief Ornament of Historic styles drawn from the casts, carvings, metal work, &c. in the South Kensington Museum, WITH WRITTEN AUTHORITIES FOR EACH; and sufficiently extensive to represent the history of the various styles selected. (On two imperial sheets.) (*See also* p. 275, directions under Group II.)

(*b.*) A set of drawings, not less than 12 in number, showing the historic treatment of drapery in sculpture when the figure is treated decoratively. (On two imperial sheets.)

(*f.*) Subject 23*f*. A Modelled design in relief of Ornament and Figures as applied to decorative Art.

and have passed "Good" or obtained a first class at the Art Examinations in—

(*g.*) Anatomy.

(*h.*) Historic Ornament.

The subjects (*g*) and (*h*) will not be required of a student who has taken the certificate for Group III.

(*i.*) Modelling design (Honours Stage).

(*k.*) Modelling from life.

(*l.*) Drawing from the life.

CERTIFICATE FOR GROUP VI.—(DOMESTIC ARCHITECTURAL DRAWING.)

Sixth Group.

This Certificate is granted to candidates who have obtained a Certificate of the First Group, and who have submitted satisfactory specimens of the following works:—

(*a.*) Subject 1*e*. A sheet of exercises in Sciography. (On an imperial sheet.)

(*b.*) „ 23*a*. (1.) A sheet containing a Measured Drawing from a Building or Exterior Portion of a Building, with the Shadows accurately projected, and tinted. (On a sheet not exceeding 48 inches by 48 inches.)

(*c.*) „ 23*a*. (2.) A Measured drawing in Outline of an Interior Decorative detail, such as a tomb, a doorway, choir stall, or the like, in stone, wood, or metal. (On a sheet not exceeding 48 inches by 48 inches.)

and have passed "Good" or obtained a first class at the Art Examinations in—

(*d.*) Perspective (Advanced Stage).

(*e.*) Historic ornament.

(*f.*) Architectural design, based on a well-known example.

and obtain a pass in

(*g.*) The Elementary Stage of Science, Subject III., Building Construction. (This is substituted for former examination in Architectural construction.)

INDEX.

	Page
Acts, technical instruction	116, 118
—— —— aid granted under	22
Admission to the National Art Training School	80, 82
—— to lectures at —— —— ——	85
—— free to Museums and Libraries	18, 85
Agriculture, principles of, syllabus	253
Aid, nature of	viii, 2
—— to art schools and classes	60
—— for drawing in elementary schools	86
—— for Local Scholarships	15
—— masters and students to visit London, &c.	79
—— to Museums	18
—— to training colleges	50, 99
—— towards the purchase of apparatus and examples	5, 6, 18, 24, 62
—— for technical instruction	22
Alterations, necessity of reporting	7, 102
Amalgamation of schools and committees	8, 70
Anatomy, as applicable to art, lectures on	84
—— syllabus of	278
Annual Report and current time table. Form No. 120	6, 26, 102
Antique, Drawing from the, syllabus of	283
—— Drawing from Memory, syllabus of	283
Apparatus, examples, and fittings, grants for	5, 6, 18, 24, 62
—— catalogues of Science	24
—— circulation of	19, 120
—— custody of	101, 107
—— for laboratory purposes, list of	200, 206, 244
—— indispensable, list of	121
—— inspection of	18, 101
—— visits of classes to inspect collections of	40
Applied mechanics, syllabus of	165
Architectural design, syllabus of	277
Architecture, syllabus of	276
Art Teachers, Certificates for	63, 99, 288
—— schools and classes, aid to	60
—— collections, circulation of	19, 20, 21
—— library, loans of books from and free admission to	18, 20, 21
—— pupil-teachers, payments on account of	74
Artizan and industrial classes	14
—— Class in National Art Training School	82
—— night classes in	32, 62
Assistants to Special Local Secretaries	8, 9
Astronomy (Nautical), syllabus of	247
Attendance of students, registration of	7, 14, 110
———— average, in elementary schools	90
Biology (general), syllabus of	224
Black-board drawing	99
Books from the Art Library, circulation of	20, 21
Botany, syllabus of	228
Branch classes of schools of art	63
Building construction, syllabus of	153
Building grant	2, 6, 24, 62, 113
Cards recording success at examination	36, 90
Carriage of works of students, payment for	72, 73
Certificated teachers under Education Department earning payment in V.	26
Certificates for Art Teachers	63, 99, 288
—— examination for, only	5
—— of success in science examinations	36
—— —— —— art examinations	63, 74, 75
—— Science Teachers', prior to 1867	25

	Page
Charities Act (City of London Parochial)	3, 25
—— —— —— —— —— Constitution of Local Committee under	3
Chemistry (theoretical inorganic), syllabus of	186
—— —— outline of experiments in	187
—— (practical) examination in	28
—— (practical inorganic) syllabus of	198
—— (theoretical organic), syllabus of	202
—— (practical organic) syllabus of	205
Circulation of science and art objects	19, 120
—— books from the Art Library	20, 21
City of London Parochial Charities Act	3, 25
Classes, Art	60, 61, 62
—— —— grants for fittings, apparatus, and examples	62
—— —— persons competent to teach in	63
—— —— premises of	62
—— —— examination of works from	31, 71
Class examinations, payments on results of	30
Committees, Local, *see* Local Committees.	
Conduct of examinations	8, 30
Contents, table of	ii
Continuation evening schools	92
Cookery, instruction of girls in	87
Custodian of examination questions	12, 103
Day schools, elementary, drawing in	86, 263
—— —— short lessons, exceptionally allowed in	26
—— Training Colleges	54
Decorative Art, aid towards purchase of objects	19
Department of Science and Art, constitution of	1
—— —— outline of its action	1
—— —— staff of	iv
Design, syllabus of	279
Dockyard students	32, 36
Donors to Museum. Free admission	18
Drawing in evening continuation schools	92
—— Training Colleges	99
—— special qualification to earn grants for	63
—— in elementary schools, and illustrated syllabus of	86, 263
Dublin Royal College of Science, Associates qualified to earn payments	25
Duties of managers of elementary schools	86
—— local committees and secretaries	101, 107
Edinburgh Museum, free admission to	18
Education Department (English or Scotch), certificated teachers under, earning payment in V.	26
Electricity and magnetism, syllabus of	184
Elementary schools, examinations of, in drawing	86, 263
—— —— manual instruction	97
—— —— definition of	86
—— —— examination of pupils of, in science	29
—— —— use of premises of	6
Endowed Schools Acts. Constitution of Local Committee under, and as to Teachers under	3, 25
—— —— payments on pupils of	32
Errors, Department not responsible for	12
Evening continuation schools, drawing in	92
Examination allowance of a separate	9
—— application for	11
—— arrangements for	8, 107
—— committee, when no payments required	5
—— conduct of	8, 30
—— day Training Colleges under the Education Department	54
—— deduction made when insufficient marks obtained at	27, 31
—— for class	26
—— for honours	26
—— papers, application for	11
—— practical for honours at South Kensington	29
—— of schools	7
—— in different subjects on the same evening	27

Page

Examination in practical chemistry and metallurgy - - - - - 28
—— of external students - - - - - - - - 11
—— of navigation schools - - - - - - - 29
—— in Science, of pupils in elementary schools - - - - - 29
—— local contributions to expenses of - - - - - - 10
—— nature of - - - - - - - - - - 7
—— rules for conducting - - - - - - 12, 127, 135
—— time table of Science subjects in 1895 - - - - - 27
—— in Art subjects, dates of, for 1895 - - - - - 69, 71
—— of works executed at Schools of Art and Art Classes - - - 71
—— questions, custodian of - - - - - - 12, 103
—— questions, return of unrequired - - - - - - 128, 137
—— questions, how sent - - - - - - 12, 105
—— refused in absence of local contribution - - - - - 10
—— superintendents of - - - - - - - - 8, 69
—— for training colleges, Science - - - - - - 50
—— —— —— —— Art - - - - - - 99
—— of students for certificates only - - - - - - 5
—— for elementary schools in drawing - - - - - 86
—— of pupil-teachers in elementary schools - - - - 69, 91
—— for payments, candidates who are ineligible - - - - 69
—— Science, Ireland - - - - - - - 56
—— for admission to National Art Training School - - - - 82
Examples, aid towards the purchase of - - - - 5, 6, 18, 62
Exhibition of national competition works - - - 72, 75
—— of objects in the provinces - - - - - - 19
Exhibitions and Scholarships, local - - - - - 15, 16
—— Whitworth - - - - - - - - 39
—— royal (Science) - - - - - - - - 37
—— —— (Art) - - - - - - - 72, 74, 76
Experimental Science, instruction in - - - - - - 24
External students, examination of - - - - - - 11
Extra grants in certain subjects - - - - - - 31
—— payments in organised Science schools - - - - - 34
Fees, exemption of payment of - - - - - - 3
—— payable by students, for instruction - - - - - 3
—— —— by candidates for examination - - - - 11, 27, 70
—— of special local secretary - - - - - - 9
—— of assistants to special local secretary - - - - - 9
Fittings of schools, grants for - - - - - - 5, 6, 24, 62
Foreign schools and galleries, visits of teachers, &c. to - - 79, 80
Forfeiture of grant - - - - - - - - 2
Form No. 51. Claim for science payment - - - - - 132
—— No. 88. Formation of local committee - - - - 106
—— No. 91. Rules for conducting a science examination - - - 127
—— No. 170. Memoranda for secretaries - - - - - 101
—— No. 526. Claim for Art payments - - - - - 141
—— No. 555. Regulations as to Building Grants - - - - 113
—— No. 802B. Circulation of apparatus and objects for instruction of Science classes - - - - - - - - - - 120
—— No. 813. Grants for Manual Instruction - - - - 99
—— No. 965c. Rules for conducting Art examinations - - - 135
—— No. 1069. Instructions for keeping Registers - - - 110
—— No. 1234. Regulations as to Science schools, teachers, and pupils in Ireland - - - - - - - - - - 56
—— No. 1284. Indispensable apparatus for teaching - - - - 121
—— No. 1294. Drawing in elementary schools - - - - 86
—— No. 1294N. Drawing in evening continuation schools - - - 92
Forms, application for - - - - - - - - - 3
Free admission to Museums and Libraries - - - - 18, 85
—— studentships - - - - - - - - 37
—— —— at schools of art - - - - - - 74, 76
—— —— at National Art Training School - - - - - 81
Freehand drawing of ornament, syllabus of - - - - - 263
Geology, syllabus of - - - - - - - - 206
Geometry (practical plane and solid), syllabus of - - - - 145
Glass cases for objects circulated in the provinces - - - - 21
Grants for apparatus, fittings, and examples - - - 5, 6, 18, 24, 62
—— for building - - - - - - 2, 6, 24, 62, 113

Page
Grants for drawing in elementary schools - - - - - 86
—— —— in evening continuation schools - - - - - 92
—— for instruction, object of - - - - - - - 1
—— for manual instruction - - - - - - - 97
—— for technical instruction - - - - - - - 22
—— may be reduced, withheld, or withdrawn 2, 5, 6, 7, 35, 86, 89, 90, 91, 98, 100, 102, 105, 106, 110
—— in organised science schools - - - - - - 33
—— extra in science subjects I., II., III., and IV. - - - - 31
—— and loans of objects, &c. to museums and schools - 18, 19, 20, 21
—— only for subjects appropriate to locality - - - - - 31
—— summary of - - - - - - - - viii
—— and privileges to teachers and students - - - - 18, 39, 79
Gratuitous instruction - - - - - - - - 8
Heat, sound, and light, syllabus of - - - - - - 167, 180
—— —— —— outlines of experiments - - - - - 180
Historic ornament, syllabus of - - - - - - - 270
Hygiene, syllabus of - - - - - - - - 261
Identification of students - - - - - - - 8
Illness of Art Masters - - - - - - - 63
Individual candidates, examination of - - - - - - 11
Industrial classes, definition of - - - - - - - 13
—— students, night classes for - - - - - 14, 62, 82
Inspection of schools and classes - - - - - - 18
Ireland, Queen's Colleges in - - - - - - 32, 36
—— special regulations for Science schools - - - - - 56
—— Training Colleges in - - - - - - - 100
Irish Schools and teachers, special regulations for - - - - 56
Laboratories, chemical and metallurgical, for Science schools - 200, 206, 244
Lectures, admission of Science teachers to - - - - - 40
—— working men's - - - - - - - - 49
Lenders to Museum, free admission - - - - - - 18
Lessons, number and duration of - - - - 6, 26, 62, 111
—— to accord with return on Form No. 120 - - - - - 7
Libraries, free admission to - - - - - 18, 85
Library, Art, circulation of works from - - - - - - 19
Life, Drawing from, syllabus of - - - - - - 283
Light, heat, and sound, syllabus of - - - - - 167, 180
—— and shade, drawing in, from a cast, syllabus of - - - - 265
Loans for permanent museums - - - - - - - 21
—— for temporary exhibitions - - - - - - 20
—— to schools of Science and Art and museums - - - 19, 20, 21
Local committees - - - - - - - 2, 3, 106
—— —— amalgamation of - - - - - - - 8
—— —— application for examination papers - - - - 11
—— —— approval of - - - - - - - 5
—— —— chairman of - - - - - - 4, 106
—— —— constitution of - - - - - - 3, 106
—— —— duties of, &c. - - - - - - 5, 101
—— —— for conducting an examination only - - - - 5
—— —— formation of - - - - - - 4, 106
—— —— identification of students by - - - - - 8
—— —— management - - - - - - - 8
—— —— member, taking the place of special local secretary or his assistant 8
—— —— permanent - - - - - - - 5
—— —— renewal of - - - - - - - 4
—— —— to meet inspector - - - - - - 18, 101
—— —— verification of attendances at schools or classes - - - 7
—— —— who ineligible to act on - - - - - - 4, 106
—— inspectors of drawing examinations in elementary schools - - 88
—— scholarships and exhibitions - - - - - 15, 16
—— —— (Art) - - - - - - - 74, 76
Machine construction and drawing, syllabus of - - - - - 149
Magnetism and electricity, syllabus of - - - - - - 184
—— —— —— outlines of experiments - - - - - 184
Maintenance allowance to students, &c. - - 29, 37, 39, 77, 78, 79, 80
Managers of elementary schools, duties of, &c. - - - - - 86

Page
Manual instruction, grants for - - - - - - - - - - - - 97
Masters, art, visits of, to London and foreign schools, &c. - - - - 79
Mathematics, syllabus of - - - - - - - - - - - - 156
Mechanics (applied), syllabus of - - - - - - - - - - 165
—— (theoretical), syllabus of - - - - - - - - - - - 161
Medals - - - - - - - - - - - - - - 15, 36, 48, 75
—— for national competition - - - - - - - - - - - 71, 75
Memoranda for secretaries and committees. Form No. 170 - - - - 101
Metallurgy (theoretical), syllabus of - - - - - - - - - - 234
—— (practical), examination in - - - - - - - - - - 28
—— —— syllabus of - - - - - - - - - - - - 242
Mineralogy, syllabus of - - - - - - - - - - - - 214
Mining (principles of), syllabus of - - - - - - - - - - 231
Model drawing, syllabus of - - - - - - - - - - - 263
Modelling, examinations in - - - - - - - - - - - 70
—— syllabuses of - - - - - - - - - - - - 284, 285
Monochrome, Painting ornament in, syllabus of - - - - - - 282
Museums and libraries, free admission to - - - - - - - - 18, 85
Museums, loans to - - - - - - - - - - - - - 19
—— masters' visits to foreign - - - - - - - - - - - 79
—— visits of classes to - - - - - - - - - - - - 40
Museums in connexion with Schools of Science and Art, grants for purchase of examples - - - - - - - - - - - - - - 18
National Art Training School, course of instruction in - - - - - - 80
—— —— —— —— prospectus of - - - - - - - - 80
—— Competition and exhibition of works - - - - - - - - 71, 75
—— scholarships (Science) - - - - - - - - - - - 36
—— —— (Art) - - - - - - - - - - - - - 74, 76
Nature of examinations - - - - - - - - - - - - - 7
Nautical astronomy, syllabus of - - - - - - - - - - - 247
Naval architecture, syllabus of - - - - - - - - - - - 155
Navigation schools - - - - - - - - - - - - - 7, 29
—— syllabus of - - - - - - - - - - - - - - 246
Night classes - - - - - - - - - - - - - 14, 35, 62, 82
Normal School of Science. *See* the Royal College of Science.
Organised science schools - - - - - - - - - - - 33, 34
—— —— course of instruction in - - - - - - - - - - 33
—— —— grants for manual instruction in - - - - - - - - 97
Ornament. *See* Design, Principles of, and Historic.
Ornamental art, lectures - - - - - - - - - - - - 85
Painting. Monochrome and Still Life - - - - - - - - - 282
Parliamentary vote - - - - - - - - - - - - - 1
Payments, science claims for (Forms Nos. 51 and 51A) - - - - 30, 132
—— in the honours stage of science - - - - - - - - - 31
—— in the advanced stage of science - - - - - - - - - 30
—— in the elementary stage of science - - - - - - - - 30
—— conditions for earning science - - - - - - - - - 30
—— qualification for earning science - - - - - - - - - 24
—— liable to be reduced, withheld, and withdrawn 2, 5, 6, 7, 86, 102, 105, 106, 110
—— pupils of endowed schools - - - - - - - - - - 32
—— restrictions on - - - - - - - - - - - - 32, 56
—— art claims for (Form 526) - - - - - - - - - - 141
—— to whom made - - - - - - - - - - - - - 13
—— for whom made - - - - - - - - - - - - - 13
—— extra in organised science schools - - - - - - - - 34
—— not made to institutions receiving State grants - - - - - 32, 35
—— special rules for, in Ireland - - - - - - - - - - 56
—— to committees of Schools of Art and Art Classes - - - - - 2, 73
—— to authorities of training colleges - - - - - - - - 50, 99
—— —— certificated teachers under Education Department in V. - - 26
—— for carriage of works for examination - - - - - - - 72, 73
—— for art pupil-teachers - - - - - - - - - - - 74
—— on account of art students and pupil-teachers - - - - 73, 74
—— —— —— free studentships and local scholarships (Art) - - - 74
—— —— —— Royal Exhibitions and National Scholarships - - - 74
—— on account for local exhibitions - - - - - - - - - 16
—— on account of pupil-teachers in elementary schools - - - - 91

	Page
Payments on results, of class examinations	30
—— —— to elementary schools	86
—— to evening continuation schools	92
Permanent committees of schools	5
—— exhibitions, loans for	21
Perspective, syllabus of	268
Physics, elementary, syllabus of	167
Physiography, syllabus of	251
Physiology, human, syllabus	218
Practical chemistry and metallurgy, examinations in	28
—— —— —— payments for	31
Practical examination in certain subjects	28, 29
Practical geometry, syllabus of	145
Premises, school	5, 24, 62
—— use of elementary school	6
President and Vice-President of council	1
Previous successes	30, 35
"Princess of Wales'" scholarships	79
Principles of mining, syllabus of	231
—— agriculture, syllabus of	253
—— of ornament, syllabus of	271
Prizes, Queen's	36, 74
—— application for	104
—— candidates eligible and ineligible for	36, 75
—— National Competition	71
—— Science and Art	15, 31, 36, 74, 99
Prospectus of the National Art Training School	80
—— of the Royal College of Science and Royal School of Mines	41
Provincial Science Colleges, assisted studentships in	39
Public Libraries Acts	25
Pupil-teachers in art schools, payments on account of	74
—— —— examination of, payments on	91
—— —— in elementary schools	69, 91
Qualification of teachers in Elementary Schools	86
—— —— art classes or schools of art	63
—— for earning payments on science results	6, 24, 51, 52
—— without examination	25
Queen's prizes	36, 74
—— candidates eligible and ineligible for	36, 75
Re-examination	13, 63
Registers	7, 26, 68, 110
—— of scholars in elementary schools	90
Regulations common to Science and Art	1
—— relative to aid to drawing in Elementary Schools	86
—— special to Science	23
—— —— —— Art	60
Rewards to students	15, 36, 47, 74
Royal College of Science, Dublin. *See* Dublin, Royal College of Science.	
Royal College of Science, London, prospectus of	41
—— —— aid to teachers and students attending	39
—— —— associates qualified to earn payments	25
—— —— studentships in training at	39
—— —— admission of science teachers to lectures at	40, 44
—— Dockyard Schools	32, 37
—— exhibitions (Science)	36
—— —— (Art)	74, 76
—— School of Mines. *See* Royal College of Science, London.	
Rules, for the conduct of art examinations	135
—— science examinations	127
Scale drawing	88
Scholarships and exhibitions	15, 16, 37, 74, 76, 78, 79, 80
—— national	37, 74, 76, 78
—— "Princess of Wales"	79
—— travelling	81
—— Whitworth	39
School Board, may constitute local committee	3
—— number to be quoted on all correspondence	5

	Page
School year of organised Science schools	35
Schools, elementary, definition and examination of, in drawing	86, 263
—— to be always open to Department's inspectors	2, 88, 108
Schools of art	60
—— —— branch classes of	63
—— —— building grants for	6, 62
—— —— grants for fittings, apparatus, and examples	62
—— —— persons competent to teach in	63
—— —— premises, &c. of	62
—— —— examination of works from	31, 71
Science classes, works sent up from	31
—— examinations, time-table of	27
—— teachers, admission to lectures	40
Science Subject I., teachers of, qualified to teach perspective	63
—— and Art Department, staff of	iv
—— library, free admission to	18
Sciography, syllabus of	268
Secretaries, special local, &c.	3, 5, 8, 9, 10, 12, 101, 107
Sound, light and heat, syllabus of	167, 180
—— —— —— outlines of experiments	180
South Kensington Museum, contents of	20
—— —— lectures at	85
—— —— free admission to	18, 85
—— —— loans from	19
—— —— visits of classes to	40
Staff of the Department of Science and Art	iv
Standard of examination liable to alteration	26
Standards of examination in drawing in elementary schools	88
State aid, instruction in institutions receiving	32, 36
Steam, syllabus of	248
Still life, Painting from, syllabus of	282
Students at National Art Training School, privileges to	85
—— in training in Art, visits of, to foreign schools, &c.	79, 80
—— of the industrial classes, definition of	13
—— rewards to	15, 36, 74
Studentships in training (Science)	39
—— —— —— (Art)	79, 80
—— —— free	37, 76, 80
—— assisted, in provincial science colleges	39
Subjects of instruction, Science	23
—— —— Art	60
Summary of principal grants made by the Department	viii
Summer courses for Science teachers	39
—— —— —— Art ——	79
Superintendents of examination	8, 70
Syllabus of science subjects	145
—— of art subjects	263
Teachers, aid to, to visit London, &c.	79
—— qualifications, &c.	6, 24
—— art, certificates for	63, 99, 288
Teaching staff	6
Technical Instruction Acts, 1889 and 1891	116, 118
—— —— —— —— Local Authority under	3, 25
—— —— —— —— aid granted under	22
—— —— —— —— Teachers under	25
Temporary exhibitions, loans for	20
Theoretical mechanics, syllabus of	161
Time table of examinations	27, 28, 69, 71
—— —— —— instruction	6
Times of meeting for instruction and teaching staff	62
Training colleges, aid to and examinations at	50, 99
—— —— (day) under the Education Department, rules for science classes in	54
—— —— rules for Science classes, English and Scotch Education Departments	50
—— —— students in, exempted from payment of fees	3
—— —— teachers in, qualified to earn payments	25
—— —— rules for	50, 99

Page
Travelling expenses to certain masters, &c. - - 29, 37, 39, 77, 78, 79, 80
—— scholarships - - - - - - - - 81
University degree a qualification for earning payments on results - - 26
Visits of teachers and students to London, foreign towns, &c. - - - 79
Visit of classes to museum - - - - - - - - 40
—— of members of local committees to schools - - - - 7, 101, 107
Vote, parliamentary - - - - - - - - 1
Whitworth exhibitions and scholarships - - - - - - 39
Works sent to South Kensington for examination - - - - 8, 31, 71
Zoology, syllabus of - - - - - - - - 226

THIRTY-SIXTH REPORT

OF THE

BOARD OF SUPERINTENDENCE

OF

DUBLIN HOSPITALS,

WITH APPENDICES.

Presented to both Houses of Parliament by Command of Her Majesty.

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CONTENTS.

	Page.
REPORT,	3
Westmorland Lock Hospital,	5
Steevens's Hospital,	6
Meath Hospital and County Dublin Infirmary,	7
Cork Street Fever Hospital,	8
House of Industry Hospitals,	9
Hardwicke Fever Hospital.	
Whitworth Hospital.	
Richmond Hospital.	
Rotunda Lying-in Hospital,	11
Coombe Lying-in Hospital,	12
St. Mark's Ophthalmic Hospital,	15
Royal Hospital for Incurables,	16
APPENDIX,	17

THIRTY-SIXTH ANNUAL REPORT

OF THE

BOARD OF SUPERINTENDENCE OF THE DUBLIN HOSPITALS.

TO HIS EXCELLENCY THE RIGHT HON. ROBERT OFFLEY ASHBURTON, BARON HOUGHTON,

Lord Lieutenant-General and General Governor of Ireland.

35, Dawson-street,
12th June, 1894.

MAY IT PLEASE YOUR EXCELLENCY :

We have the honour to lay before Your Excellency our Thirty-sixth annual Report on the condition and management of the City of Dublin Hospitals receiving Parliamentary Grants, and which were duly inspected by us during the year ended 31st March, 1894.

These are :—

1. Westmorland Lock Hospital.
2. The House of Industry Hospitals, viz. :—
   a. Hardwicke Fever Hospital.
   b. Whitworth Medical Hospital.
   c. Richmond Surgical Hospital.
3. Steevens's Hospital.
4. Meath Hospital and County Dublin Infirmary.
5. Cork-street Fever Hospital.
6. Rotunda Lying-in Hospital.
7. Coombe Lying-in Hospital.
8. St. Mark's Ophthalmic Hospital ; and
9. Royal Hospital for Incurables, which receives a portion of the Concordatum Fund.

As mentioned in former Reports, our inspections are made without any previous notification to the officials of the several Hospitals.

We inquired into the condition of each Institution, to ascertain if the buildings were in good order, the general management satisfactory, and if due provision were made for the comfort and welfare of the patients.

We examined the dietaries in use, and the manner of serving the food to the patients.

As hygienic measures have assumed so great importance and so extensive a development, special inquiry was made in each

Hospital to determine if due care were bestowed on ventilation, drainage, cleanliness, and the proportion of inmates to space.

We lay stress on the necessity of combating infectious diseases by isolation, segregation, disinfection, and the speedy removal of patients to Hospital, and we have ascertained that these precautions have been carried out as far as possible.

We also lay stress on the necessity of every Hospital receiving Parliamentary Grants in Dublin having a fully qualified Resident Medical Officer as well as a Trained Lady Superintendent, or Matron fully trained as an Hospital nurse, and holding a *bona fide* certificate of such qualification.

Although it does not come strictly within our province, we nevertheless think it right to draw Your Excellency's attention to the importance of a project that has recently been set on foot (following a suggestion contained in our Thirty-fourth and Thirty-fifth Reports) by an influential committee, whose object is the establishment of a Central Pathological Institute in connection with the Dublin Hospitals.

An enormous amount of valuable pathological material which, from its disseminated occurrence, is at present only available for teaching purposes to a limited extent, could thus be fully utilised. It would consist of the *post-mortem* and operation theatre specimens from the various Hospitals, unclaimed bodies from the Unions and the Richmond Asylum. These would form the subject for high-class pathological instruction which would be largely availed of by students. Medico-legal autopsies should, in our opinion, be performed at the proposed Institute, and the student would thus enjoy the advantage which he does not at present possess of seeing this important operation thoroughly and systematically carried out.

A bacteriological laboratory would form an indispensable adjunct to the Institute, and would be devoted to the examination of morbid secretions, and to the diagnosis by the most recent methods of doubtful zymotic diseases in men and animals, as well as to the elucidation of local epidemics, cases of meat-poisoning, &c.

Examinations of water, milk, food-stuffs, &c., by bacteriological methods, could here be conducted by a skilled bacteriologist.

Such an institution would, in our opinion, serve to supplement the work of our Dublin Hospitals in several important particulars, and fulfil many functions that are at present discharged imperfectly, or not at all. It would, we consider, constitute a most essential adjunct to the existing resources of medical education in this city.

The various Statistical and other Tables in Appendices will be found similar in character to those that have hitherto appeared in regular annual sequence, but at the same time indicative of the relative changes and results in the operation of the different institutions.

The financial accounts are rendered in a uniform system, so that it can be seen whether any Hospital is extravagant in its expenditure as compared with others.

On the 1st of April, 1893, there remained 773 patients in these Hospitals under the supervision of our Board.

The number admitted during the year was 10,335, making the whole number under treatment 11,108, of whom 9,882, left the wards either cured or relieved, or were discharged for other causes, and 484 died.

Seven hundred and seventy-three patients remained under treatment in these Hospitals on the 31st March, 1894.

Exclusive of incurables, the mortality was 4·47 per cent. on those treated to a termination.

The total daily average number of beds occupied in these Hospitals throughout the year was 793.

The time spent in Hospital by each patient under treatment (omitting the patients in the Royal Hospital for Incurables) averaged 20·57 days.

Appendix.—Table No. 1 shows a list of diseases of patients treated in the several Hospitals and the number that died of any particular disease during the year ended 31st March, 1894.

Table No. 2 shows the average cost per bed occupied throughout the year ending 31st March, 1894, for maintenance and for establishment, and for both, exclusive of buildings and furniture.

Table No. 3 shows the several sources of income of each Hospital.

Table No. 4 sets forth in detail the chief heads of expenditure of each Hospital.

Table No. 5 gives the number of patients treated in each Hospital, the mortality per cent., the average daily number of beds occupied during the year, and the present extent of accommodation for each class of patients.

Table No. 6 shows the prices of articles supplied to each Hospital per contract or otherwise.

Table No. 7 gives the various dietaries in use in each Hospital.

Table No. 8 gives the names of the Governors of each Hospital, and number of attendances during the year.

Lock Hospital.

We found this Hospital, on inspection, clean and orderly. The various samples of food were of good quality.

As regards the wards, we must repeat what has often been said, that they are on the whole very bare and cheerless, and in the matter of decorations are much behind the standard of the present day.

A large supply of light and attractive literature is still needed, and we feel sure that periodicals and illustrated papers, and books of a popular character, would be much appreciated by the patients.

In previous Reports we noticed several particulars in which improvements were desirable. We are glad to say that many of these suggestions have been adopted and carried into effect; but we regret to report that we again found the laundry in the same faulty position, underneath an occupied ward. We expressed an opinion on several occasions, that no washing should be done in

or near the wards, as it must be injurious and unwholesome to the inmates.

We observed that the lavatory arrangements were not quite perfect, the basins are of an old pattern, and we found two cracked; as the pipes leading from these basins are liable to get stopped with soap, and the plugs to be lost, we suggest that "Tip basins" be substituted, which would obviate every inconvenience in this respect.

We have made the customary inquiries as regards the care and attention bestowed on the patients by the attendants and have received invariably satisfactory replies.

There were 71 patients in this Institution on the 1st of April, 1893; 635 were admitted, and 12 infants were born in the house during the year; 634 patients were discharged; 15 died; and 69 remained on the 31st March, 1894.

The mortality was 2·31 per cent. on the total number treated to a termination.

The time spent in Hospital by each patient averaged 38·61 days, and the average daily number of beds occupied during the year was 76.

Steevens's Hospital.

On visiting the several departments of this Hospital we were much gratified by the order, regularity, and cleanliness which prevailed. The wards were well ventilated, the supply of linen ample, and the laundry arrangements good.

As usual, we inquired of the patients as to the care bestowed on them by the attendants, and are glad to report that their replies were satisfactory.

The dietaries of the patients have been carefully revised; butter and vegetables being added so as to secure greater variety of food.

Food safes have been provided for each group of wards, thus ensuring greater cleanliness and economy. Improvements have also been made in the manner of supplying and serving the food to the patients; but considering the distance the kitchen is from the wards, it would be advisable to provide a lift, which would economise labour, and without difficulty enable the dinners to be served hot to the patients.

We made inquiries as to the manner of preparing the tea, which was mentioned in a former Report, as needing improvement. We have now learned that it is prepared in each ward kitchen, which seems to give satisfaction to the patients.

We were much pleased to learn that under the present intelligent and efficient Lady Superintendent the Private Nursing Department has been greatly developed during the past year, the funds of the Hospital having been augmented by a sum of £213 derived from that source.

We ascertained that the nurse of each ward has an exact inventory of all ward utensils, linen, and other property in her charge, and these inventories are compared with the articles at least once a month.

We have been informed that the Governors have under consideration the complete remodelling of the out-door patient department, but are only deterred from undertaking same by the want of funds.

As the Medical Staff is represented on the Governing Body, we believe the most enlightened principles of Hospital management are carried out, and if such did not exist the blame should rest on the Medical Officers. We were, however, not favourably impressed with the post-mortem room, which we found much behind modern requirements, and hope that the Governors may soon be able to make more suitable arrangements.

In a former Report we urged the necessity of having this apartment sufficiently spacious, well-lighted, and drained, and that it should be supplied with hot and cold water.

The mortuary should also be in a separate adjoining apartment, and appropriately arranged, so as to show proper respect to the feelings of the friends of deceased patients.

On the 1st of April, 1893, 87 remained in Hospital; 1,266 were admitted during the year; 1,190 were discharged; 47 died; and 116 remained on the 31st March, 1894.

The mortality was 3·79 per cent. on the total number treated to a termination.

The time spent in Hospital by each patients averaged 23·78 days, and the average daily number of beds occupied during the year was 88·15.

The Meath Hospital.

We carefully examined the several departments of this Hospital, and found the buildings in good order, and the wards clean and bright.

We ascertained that the supply of linen was sufficient, and that each ward was provided with towels for the use of patients, and those who were unable to perform ablution in the lavatories are attended each morning by a nurse who is responsible for their personal cleanliness.

The various articles of food which we examined were, without exception, of good quality, and the cooking was satisfactory.

On the day of inspection we were of opinion that the male accident ward was somewhat overcrowded, and the beds in too close proximity. We have since been informed that this insufficient accommodation has from time to time occupied the attention of the Committee, but hitherto they have been prevented, by the want of the necessary funds, from erecting the much-needed additional wards; they hope, however, very soon to be able to undertake this work.

Amongst the improvements we observed that the ward kitchens and sculleries on each of the three landings of the main building have been recently tiled.

The sanitary arrangements of the Hospital having been considered defective, an entirely new system of sewerage has been carried out, at a cost of £295, under the direction of Mr. J. T. Fuller, architect.

The lavatories and water-closets have been kept in perfect working order, and also the baths, which are well supplied with hot and cold water.

We observed in the Apothecary's department the greatest care is taken to be prepared for any emergency in case of poisoning. The various antidotes, together with all necessary apparatus, are kept ready for immediate use.

We were also informed that a new Fever wing will very soon be erected in the Hospital grounds, which will confer a great benefit on the sick and suffering poor of the county and city of Dublin.

There were 94 patients in this Hospital at the commencement of the year; 1,273 were admitted; 1,201 discharged; 71 died; and 95 remained on the 31st March, 1894.

The mortality was 5·58 per cent. on the total number treated to a termination.

The time spent in Hospital by each patient averaged 23·72 days, and the average daily number of beds occupied during the year was 88·84.

Cork-street Hospital.

It is satisfactory to be able to report that this institution continues to be conducted with great efficiency. The same care which we observed on previous visits with regard to the condition of the wards and the treatment of the patients was apparent.

The arrangement for emptying, rinsing, and disinfecting ward utensils, is creditable, an example which might be followed in other Hospitals.

The sewerage of the Hospital is said to be satisfactory, having been examined and reported on by the Resident Engineer of the Dublin Sanitary Association.

From the returns we learn that the resources of the institution have been for the past year specially taxed by reason of the prevalence of epidemic diseases; and although the number of patients treated is far in excess of the average, all suitable cases have been admitted, and the various diseases segregated.

We were much pleased with the new epidemic house which has replaced the old wooden structure, originally occupied as a temporary hospital during the small-pox epidemic.

This building consists of two landings, perfectly separated from each other, containing respectively two medium-sized wards, and one isolated room for suitable cases. The kitchen, lavatories, and sanitary arrangements are well designed. Each story has an attached verandah for patients to exercise in the open air under cover, so that the danger of mingling with other hospital patients is avoided.

Owing to the dearth of water during the late autumn and early winter, and consequent low pressure, the Managing Committee have been obliged to put in a series of pipes from the laundry pumps to fill each of the closet tanks, thus securing an ample supply of water for flushing purposes at any time.

St. Vincent's, Steevens's, and Jervis-street Hospitals have made arrangements by which they send their nurses to this Hospital for a three months' training in fever nursing. This scheme is carried out without any friction, and appears to give general satisfaction.

At the commencement of the year 78 patients remained in the Hospital; 1,656 were admitted; 1,510 were discharged; 146 died; and 78 remained on the 31st of March, 1894.

The mortality was 8·81 per cent. on those treated to a termination. The average daily number of beds occupied was 108·08, and the time spent in Hospital by each patient averaged 22·75 days.

House of Industry Hospitals.

The administration of these Hospitals is able and successful. The fact that members of the medical staff are on the Governing Board gives vitality to its management and obviates unnecessary friction. The expenditure on extra diets, stimulants, and in the pharmaceutical department, is specially supervised by them, which is a means of controlling this expenditure, or at least of fixing the responsibility for it, should it be found excessive.

The wards presented a cheerful appearance, and the beds and bedding were properly looked after. Satisfactory replies were given to us by the patients, whom we interrogated on the subject of their fare, its cooking and service.

We were informed that there is always an available supply of hot water for baths, but we were sorry to observe that those which we inspected were worn and unsightly, and we consider they should be renewed, or, better still, earthenware substituted for metal.

We have ascertained that the Governors pay regular visits to the wards, and give the patients every opportunity of speaking with them.

The refuse of the Hospitals is removed daily by the Dublin Corporation carts. We would again advert to the close proximity of very objectionable dairy yards to the Richmond and Whitworth Hospitals. We were informed that during the winter season 150 to 200 cows are housed in very small space under the windows of the Hospitals. We need not point out that such mephitic centres spread abroad organic emanations which must be injurious to the patients. We are further of opinion that dairy yards in a city are at all times a serious danger to the public health.

We hope that the Public Health Committee of the Dublin Corporation, which is vested with ample power, will require these yards to be concreted and cleaned daily, so that the accumulated refuse should not permeate the soil.

We were much pleased to inspect the detached building recently constructed in connection with the Hardwicke Hospital for the segregation of certain cases of infectious diseases.

The building is two stories high, with a separate pavilion for

patients, divided from the nurses' wing by the staircase and corridors. On the ground floor of the pavilion there is a ward for male patients with windows on each side, and also on the south end. At the further end of this ward is the sanitary block, separated from it by a lobby and passage, from which open the baths, water-closets, and sculleries. These are fitted up with the most approved modern appliances, and have thorough cross ventilation. On the upper floor of the pavilion is the ward for female patients, with sanitary arrangements similar to those on the ground floor. These wards are of a moderate size, as the object is to prevent the spread of contagion by the segregation of patients when first attacked, and not so much to meet the occurrence of an extensive epidemic.

We believe a Hospital is necessary in this populous locality for the reception and treatment of cholera, small-pox, and fever patients. The removal of such cases to a distance is objectionable, as tending seriously to impair the patients' already feeble powers.

The various financial accounts appeared to be well and carefully kept, and are checked regularly by the Governors at their monthly meetings.

We have been informed that Mrs. Byrne, lately Matron of the Institution, having retired, the Governors have recommended her for a pension on her superannuation.

Miss MacDonnell, Superintendent of Nurses in the Richmond Hospital, has been appointed to the office of Lady Superintendent of the three Hospitals, and is also now responsible for the fulfilment of the duties relating to the kitchen and laundry departments, formerly performed by the Matron, in addition to the control of the nursing establishment.

A large and increasing number of trained and skilled nurses are supplied as required to private patients in all parts of the county, and bring in an income in aid of the Hospital funds.

Hardwicke Hospital.

Thirty-seven patients remained in this Hospital on the 1st of April, 1893; 580 were admitted during the year; 539 were discharged; 55 died; giving a mortality of 9·25 per cent. on the total number of cases treated to a termination.

The average daily number of beds occupied during the year was 39·83, and the time spent in Hospital by each patient averaged 23·56 days.

Whitworth Hospital.

On the 1st of April, 1893, 34 patients remained in Hospital; 541 were admitted; 496 were discharged; 45 died; giving a mortality of 8·31 per cent. on the total number of cases treated to a termination.

The average daily number of beds occupied throughout the year was 34·84, and the time spent in Hospital by each patient under treatment averaged 22·12 days.

Richmond Hospital.

There were 62 patients in this Hospital when the year commenced; 703 were admitted, including one born in the house; 688 were discharged; 23 died; giving a mortality of 3·23 per cent. on 711 cases treated to a termination.

The average daily number of beds occupied in the year was 51·94; and the time spent in Hospital by each patient averaged 24·78 days.

The Rotunda Lying-in Hospital.

For several years we have observed marked and continued progress and improvement in this Hospital. We found the wards in excellent order, and the condition and treatment of the patients in every respect satisfactory.

The chief structural work at present in progress is the erection of a new auxiliary Hospital to be provided with all modern improvements, well-ventilated wards, good sanitary accommodation, operating theatre, &c.

This structure will be connected with the main building by a corridor on each landing, and the lift and sanitary block are so arranged that they will be equally of use to both houses.

There are also provided closets for soiled clothes, disinfecting chambers, and stores for patients' clothes, &c.

The ground floor provides for dispensary, waiting-rooms, &c., servants' and wardmaids' bedrooms, and private wards.

The first-floor ward has accommodation for 32 beds, also private wards, theatre, kitchen, and nurses' room.

Above this floor arrangements are made for bedroom accommodation for both night and day nurses, superintendents, and charge nurses' rooms, workrooms, &c.

The exterior is to be carried out as much as possible in the same style as the main building, except substituting red brick in walls instead of stone.

We hope soon to see this much-wanted addition completed, for it will be a great benefit to the patients, and from its close proximity to, and connection with the main building, a saving in the working of the institution will be effected.

We hope that the post-mortem room is to be sufficiently spacious and well ventilated, with the most approved means of renewing the atmosphere; otherwise persons who attend at autopsies are liable to carry infection in their clothes, hands, and hair, from emanations from the dead—a fruitful and unsuspected source of the spread of disease.

We are glad to be informed that the Dublin Corporation have restored to this Hospital the annual grant of money which they had withdrawn some years ago; they considered that they were not justified in appropriating the funds of the city to any institution over whose administration they had no control.

We have already expressed an opinion on this subject, and consider that a self-elected governing body of a Hospital supported by the public is objectionable, and particularly in this institution, as the selection of Governors is limited to persons

who have paid £50, or to annual subscribers of £10, the numbe of Governors not to exceed sixty. We hope that steps may soon be taken to amend the Charter so as to give effect to the recommendations of the Dublin Hospital Commissioners of 1856 and 1885.

On the 1st of April, 1893, there were 27 patients in the labour wards; 1,772 were admitted during the year; 1,402 were discharged after delivery; 344 were discharged, not having been delivered 17 died; and 36 remained in Hospital at the end of the year.

Thirty-two patients remained in the auxiliary or chronic department on the 1st of April, 1893; 447 were admitted; 441 discharged; 16 died in the year ended 31st March, 1894; and 22 then remained.

The average daily number of beds occupied throughout the year by labour cases was 35·21, and that of the chronic class 26·36.

The time spent in Hospital by labour cases averaged 7·14 days, and that by the chronic class 20·08 days.

The mortality of the labour patients, deducting non-parturient cases, was 1·19 per cent., and that of the chronic class 3·5 per cent.

The Coombe Hospital.

This Hospital, situated in a poor part of the city, has had for many years a reputation for benevolence and efficiency; but in July certain irregularities in the internal management of the Hospital having been brought under the notice of the Board of Guardians and Directors, they asked for our interposition, and, at their request, we deemed it our duty to institute a sworn Inquiry into these alleged charges.

After a most exhaustive investigation, and having held several meetings thereon, and having examined all those whom we considered could afford information to our Board, we arrived at the following conclusions as the result of this Inquiry:—

1st. That due supervision and discipline were not observed, which caused great irregularity in the working of the Hospital.

2nd. That the necessary antiseptic precautions were not enforced for the welfare and safety of the patients.

3rd. That drunken and uncivil servants were employed in the Hospital.

4th. That great waste in material and expenditure were caused by the want of proper supervision and care in the Pharmaceutical Department.

5th. The alleged charges of immorality were unsupported by facts.

The following suggestions and recommendations were drawn up by us, and forwarded for the guidance and adoption of the Managing Committee:—

1st. The election of a highly professionally educated Master, with capacity and executive ability, to administer and command judiciously but firmly.

2nd. The election of a Lady Superintendent and Matron, with tact and administrative ability, fully trained as a hospital nurse, and holding a *bonâ fide* certificate of such training.

3rd. That the Rules for the management of the Pharmaceutical Department be entirely re-cast, and that a proper, competent, and responsible official be appointed, who should prevent unauthorized persons entering this Department and carrying away medicine without check or hindrance.

Having regard to the several Dispensaries in the vicinity of the Coombe, the Board of Superintendence are of opinion that the Extern Dispensary of the Hospital should be limited to patients solely affected by diseases peculiar to women.

4th. The Board consider that the Hospital is not supplied with capable or efficient nurses; and recommend the election of at least three fully trained Charge or Staff Nurses for the Departments, and one fully trained Night Staff Nurse.

The system of placing the lives of patients in the sole charge of probationary nurses of two or three months standing cannot be too strongly condemned. We recommend also that rules for the guidance of the nurses should be drawn up, with the view that antiseptic precautions be more efficiently carried out in the wards.

5th. The Board recommend that two members of the Governing Body be elected each month to act as a Visiting Committee, to inspect the Hospital, and visit every department, confer with the different officials, and make a report in writing for each meeting of the Board of Directors.

6th. The Board of Superintendence recommend a change in the Charter for the election of the Managing Committee, and suggest that the election be annual on a stated day in the year, and that the Managing Committee be elected from the annual subscribers of two guineas, or from the life governors who have paid a single subscription of twenty guineas.

We are glad to report that several of these recommendations have been carried out, and the present Master has already displayed much energy, earnestness, and conscientiousness; and we have no doubt that this Institution will ere long occupy a prominently good position.

In reference to the above recommendations made by us, we have received the following letter in reply :—

"Coombe Lying-in Hospital, Dublin,
"29th March, 1894.

"My Lord,

"Referring to your Lordship's communication of the 9th January, 1894, I am directed by my Board to convey their grateful thanks both to your Lordship and to the Board of Superintendence of the Dublin

Hospitals for their gracious compliance with the request of the Guardians and Directors, in holding a sworn Inquiry into the alleged irregularities in the management of this Hospital.

"With reference to the six recommendations which you have so kindly submitted for their future guidance, I may mention what has been, and is being done—viz. :—

"RECOMMENDATION I.

"On the 14th December, 1893, the Guardians and Directors elected, in the terms of their Charter, Frederick William Kidd, Esq., M.D., Univ. Dub., as a Master, a gentleman, they feel confident, eminently possessing the qualifications which you suggest they should require.

"RECOMMENDATION II.

"On the 22nd February, 1894, the Board elected Miss Hester Egan out of thirty-two applicants. This lady was fully trained in the Meath Hospital (1889 and 1890), and afterwards obtained the Diploma of the Obstetrical Society of London. She entered on her duties on the 1st instant, and is carrying them out in every particular, to the complete satisfaction of the Master and Board.

"RECOMMENDATION III.

"The rules mentioned in my letter of the 28th November, 1893, with regard to the supervision of the Drug Department and Apothecary's shop, are being strictly carried out. I may also add that the Master now countersigns all orders for drugs, and that the key of the Drug Department is in the custody of the Assistant Master on duty.

"As to the Extern General Dispensary, the Master considers it a very valuable recruiting ground in obtaining patients for the special Dispensary, and to restrict it in any way he considers would do grievous harm to the Gynæcological Department of the Institution, and largely limit its teaching power.

"RECOMMENDATION IV.

"The Master has carefully considered the nursing arrangements, and recommends a Staff Nurse on each landing in the Labour House, and a Staff Nurse in the Chronic Department. The latter Staff Nurse to be assisted in her duties by such Probationers from the Labour House as may be arranged or directed by the Matron or Medical Staff.

"In the Labour House each Staff Nurse to act as a night nurse on the landing in turn, and to sleep in the ward where patients are convalescing.

"The Master does not consider that with the foregoing arrangements Night Nurse would be necessary or desirable.

"As to antiseptic precautions, the Master has reported that he has laid particular stress on this point in his instructions to the Nurses since his appointment; that he has been ably seconded in this by his Assistant Masters; and that it is his intention to draw up rules for the guidance of Nurses and Students on this important subject, and have same printed and hung up in each ward.

"RECOMMENDATION V.

"Monthly Visiting Governors have been appointed since January last, and they have recorded the results of their careful inspections in the Visiting Committee's Report Book.

"RECOMMENDATION VI.

"As to the concluding recommendation of your Lordship's Board, my Guardians and Directors do not believe that it would be conducive to the interests of the Hospitals at present to seek for a change in their Charter, especially as the selection of Guardians and Directors has been, and is practically made among the classes mentioned in the recommendation.

"I have the honour to remain

"Your Lordship's obedient servant,

"(Signed), H. LEONARD, Registrar.

"The Right Hon. Viscount Powerscourt, K.P., &c., &c.
Chairman of the Board of
Superintendence of the Dublin Hospitals."

Eight labour patients remained in Hospital on the 1st of April, 1893; 472 were admitted during the year; 463 were discharged; 109 were discharged not having been delivered; 4 died; and 13 remained at the close of the year.

Ten patients remained in the chronic wards on the 1st of April, 1893; 241 were admitted; 242 discharged; 1 died; and 8 remained at the close of the year.

The average daily number of beds occupied throughout the year by labour cases was 9·02, and by chronic cases 9·41.

The time spent in Hospital by labour patients averaged 6·86 days, and that by the chronic class 13·69 days.

The mortality of patients admitted to the labour wards, deducting 109 that were discharged not having been delivered, was 4 deaths in 358 cases, or 1·11 per cent., and for the chronic class 1 died, giving a mortality of 0·41 per cent.

ST. MARK'S OPHTHALMIC HOSPITAL.

This important and useful Institution has been efficiently worked during the past year as far as circumstances would admit, and it has maintained its high reputation for teaching; but the structural defects of the building, and the want of proper accommodation, have to a great extent impeded the sphere of its usefulness. We were glad, however, to be informed that negotiations for bringing about an amalgamation of this Institution and the National Eye and Ear Infirmary have been continued during the past year, and will, it is expected, be shortly completed, there being now but one or two matters of small detail to be settled between the governing bodies, and these it is proposed to refer to arbitration.

On the 1st of April, 1893, 50 patients were in Hospital; 689 were admitted during the year; 694 were discharged; and then 45 remained.

The average daily number of beds occupied during the year was 45·48, and the time spent in Hospital by each patient averaged 22·46 days.

The Royal Hospital for Incurables.

This Hospital continues to deserve the favourable comments we have made in former Reports as to its general administration, and as to the kindness and attention bestowed on the patients. The efforts of the Governors to develop the resources of the Institution have been gratifying and encouraging, and the financial condition is so good that it is expected that two new wards will be opened in May or June next. These wards will contain forty-eight beds and have a southerly aspect, and are in every way well sheltered and most suitable for invalids suffering from chest affections.

It is contemplated to allot the upper floor ward to consumptive female patients. This Institution deserves, in our opinion, the highest praise, as its great extent and admirable arrangements minister in the best manner to the comforts of the closing days of its inmates.

One hundred and eighty-three patients remained in Hospital on the 1st April, 1893; 48 cases were admitted; 7 were discharged or resigned; 44 died during the year; and 180 remained on the 31st March, 1894.

The mortality was 86·27 per cent. on the total number of cases treated to a termination.

The time spent in Hospital by each patient averaged 284·15 days.

The average daily number of beds occupied throughout the year was 179·83.

POWERSCOURT, *Chairman.*
FRANCIS W. BRADY, Bart.
ARDILAUN.
GEORGE H. PORTER, Bart.
SAMUEL GORDON, M.D.
JOHN E. BARRY.
JOSEPH WOODLOCK.
PERCY R. GRACE, Bart.
JOHN BANKS, K.C.B.
LAMBERT H. ORMSBY, M.D.
CHARLES E. LAMBKIN.
THOMAS A. DICKSON, P.C.

WILLIAM J. MARTIN, *Secretary*

APPENDIX.

Appendix.
No. 1.

Table No. 1.

A Classified Return of the Diseases of Patients treated in the Hardwicke Fever, Whitworth Medical, and Richmond Surgical Hospitals; of the number of such Patients affected with, and of the number that died of, any particular Disease during the Year ended 31st March, 1893, as compiled by Dr. Samuel Mathews, Resident Physician.

House of Industry Government Hospitals.

Hardwicke Fever Hospital.

The Hardwicke Fever Hospital.

Disease.	No. Treated.	No. Died.	Disease.	No. Treated.	No. Died.
Abscess,	2	1	Influenza,	22	–
Alcoholism,	6	1			
Anthrax,	1	–	Lumbago,	1	–
Bronchitis, Acute,	2	–			
,, Chronic,	3	–	Melæna,	2	–
			Meningitis,	4	4
			Minders of Children,	4	–
Cancrum oris,	1	–			
Colic,	1	–			
Cellulitis,	2	–	Neuritis Multiple,	1	1
Constipation,	1	–	Nephritis,	2	–
Diarrhœa,	5	–	Otitis,	1	–
Diphtheria,	2	1			
Dropsy,	1	–			
Debility,	1	–	Pericarditis,	1	–
			Peritonitis,	2	1
			Pertussis,	11	5
Eczema,	1	–	Phthisis Pulmonalis,	4	2
Empyema,	1	–	Pleuritis,	5	–
Enteritis,	2	1	Pneumonia,	52	9
Erysipelas,	69	6	Pyæmia,	2	1
			Scabies,	1	–
Fever,	33	–	Scarlatina,	74	–
,, Typhus,	32	5			
,, Typhoid,	127	14	Tonsillitis,	10	–
,, Rheumatic,	6	–			
,, Measles,	75	2	Urine, Infiltration of,	1	1
			Urticaria,	1	–
Hæmorrhoids,	1	–			
Heart, Disease of,	3	–	Varicella,	1	–

Appendix.

No. 1.

Whitwort Medical Hospital.

WHITWORTH MEDICAL HOSPITAL.

Disease.	No. Treated.	No. Died.	Disease.	No. Treated.	No. Died.
Abscess,	2	–	Icterus,	8	–
Alcoholism,	15	–	Influenza,	20	–
Alveolar Abscess,	1	–			
Amenorrhœa,	1	–			
Anæmia,	8	–			
Aneurism, of	2	1			
Amyloid Disease,	3	1	Lumbago,	3	–
Anthrax,	2	–			
Arthritis,	1	–			
			Mania,	1	–
			Melancholia,	1	–
Bronchitis, Acute,	19	2	Meningitis,	1	1
,, Chronic,	10	4	Myxœdema,	1	–
			Necrosis,	1	–
Cancer, of	4	3	Nervous Tremors,	1	–
Chlorosis,	3	–	Neuritis,	6	–
Chorea,	6	–	Nephritis,	23	6
Cirrhosis of Liver,	11	5	Neuralgia,	1	–
Constipation,	10	–			
			Paralysis,	3	–
Diabetes,	4	–	Pain in Abdomen,	1	–
Diarrhœa,	1	–	Paraplegia,	6	1
Dropsy,	7	–	Phlebitis,	2	–
Debility,	7	1	Phlegmasia dolens,	1	–
Dysentery, Chronic,	1	–	Phthisis Pulmonalis,	52	4
Dyspepsia,	21	–	Pleuritis,	10	–
			Pneumonia,	23	4
			Psoriasis,	4	–
Ecthyma,	1	–	Purpura,	2	–
Eczema,	8	–	Pyelitis,	3	–
Empyema,	2	1			
Endometritis,	2	–			
Epilepsy,	5	–	Rheumatism, Acute,	36	–
Epistaxis,	1	–			
Erysipelas,	4	–			
Erythema,	2	–	Sciatica,	10	–
			Scarlatina,	1	–
			Scorbutus,	1	–
Fever,	10	–	Syringomyelia,	1	–
,, Typhus,	1	–	Sclerosis Disseminated,	1	–
,, Typhoid,	15	1	Stone in Bladder,	1	–
Fracture, Neck of Femur,	2	–	Stricture of Urethra,	1	–
			Synovitis,	2	–
			Syphilis, Primary,	3	–
Gangrene of Mouth,	2	–	,, Tertiary,	2	–
Goitre,	2	–	Strangulation Intestinal,	1	–
Gout,	4	–			
Glands Enlarged in Neck,	1	–			
Gastritis,	9	–	Tetanus,	1	1
			Tonsillitis,	7	–
			Tumour of Brain,	1	–
Hip Disease,	1	–	,, Abdomen,	3	1
Hæmorrhoids,	1	–	,, Fatty,	2	–
Heart, Disease of,	64	6	Typhlites,	3	–
Hemiplegia,	3	–			
Hydrocephalus,	1	1			
Hypochondriasis,	3	–	Ulcer,	4	1
Hysteria,	2	–	,, Roden,	1	–

RICHMOND SURGICAL HOSPITAL.

Disease.	No. Treated.	No. Died.	Disease.	No. Treated.	No. Died.
Abscess,	44	1	Ectropium,	1	–
,, Mastoid,	2	–	Eczema,	3	–
,, Psoas,	7	–	Empyema,	1	–
,, Ischio-rectal,	2	–	Enchondroma of Tarsus,	1	–
,, Perityphlitie,	1	–	,, Metacarpus,	1	–
,, Alveolar,	2	–	Entropium,	1	–
,, Cerebral,	1	1	Epilepsy,	1	–
Amyloid,	1	1	Epistaxis,	1	–
Anasarca,	1	–	Epididymitis,	4	–
Anæmia,	1	–	Erysipelas,	1	–
Aneurism of Aorta,	2	–			
,, Traumatic of Radial,	1	–			
Adenoids, Post-nasal,	5	–	Fistula in Ano,	9	–
Angioleucitis,	1	–	,, Perineum,	5	–
Anthrax,	2	–	,, Vesico intestinal,	1	–
Ankylosis of Elbow Joint,	1	–	Fracture Elbow-joint,	2	–
Appendicitis,	1	–	,, Colles' double,	1	–
			,, Ribs,	1	–
			,, Skull,	3	2
Bronchitis, Acute,	1	–	,, Tibia,	6	–
Bubo,	3	–	,, Fibula,	4	–
Burns,	6	–	,, Ulna,	1	–
Bursitis,	2	–	,, Patella,	2	–
			,, Metacarpal bones,	2	–
Cancer of Penis,	2	–	,, Pott's,	3	–
,, Submaxillary Gland,	1	–	,, Humerus,	1	–
,, Jaw,	2	–	,, Jaw,	1	–
,, Tongue,	1	–	,, Nasal bones,	2	–
,, Pharynx,	1	–	,, Coracoid Process of Scapula,	1	–
,, Scrotum,	1	–	,, Femur,	8	–
,, Breast,	9	–	Furuncle,	3	–
,, Rectum,	2	1			
,, Lip,	12	–			
,, Pylorus,	1	–			
,, Larynx,	1	1	Gangrene of Penis,	1	–
,, Bladder,	1	1	Gastritis,	1	–
Cancrum Oris,	1	–	Ganglion,	2	–
Carcinoma,	5	–	Gonorrhœa,	1	–
Caries of Spine,	10	–			
,, Femur,	1	–			
,, Tarsus,	8	–			
Calculus in Bladder,	3	1	Hæmatemesis,	1	–
,, Kidney,	1	–	Hæmatocle,	1	–
Cataract,	2	–	Hæmatoma,	1	–
Cellulitis,	10	–	Hæmorrhoids,	11	–
Concussion of Brain,	5	2	Hare Lip,	4	–
Contractures of Cicatrices,	4	–	Heart, Disease of,	1	–
Conjunctivitis,	1	–	Hepatitis,	2	–
Contusion,	4	–	Hernia,	32	1
Cyst, Sebaceous,	2	–	Hydrocele,	9	–
,, Blood of Thyroid,	1	1	Hysteria,	1	–
,, Mammary,	1	–			
Cystitis,	5	1			
Convulsions,	3	1	Inflamation of Eustachian Tube,	1	–
			,, Cervical Glands,	2	–
Debility,	2	–	Intestinal Worms,	1	–
Dermatolysis,	1	–	,, Obstruction	2	1
Drowning,	1	–	Ingrowing Toe-nail,	2	–
Dyspepsia,	1	–	Iritis,	1	–

[continued.

Appendix.

No. 1,

Richmond Surgical Hospital.

RICHMOND SURGICAL HOSPITAL—*continued.*

Disease.	No. Treated.	No. Died.	Disease.	No. Treated.	No. Died.
Laryngitis,	2	–	Sprain,	2	–
Lipoma,	2	–	Sinus,	7	–
Loose Cartilages in Knee Joint,	1	–	Strabismus (double convergent),	1	–
Lupus,	2	–	Stricture of Œsophagus,	1	1
Luxation of Ankle,	1	–	,, Urethra,	15	–
,, Hip,	2	–	Synovitis,	14	–
,, Shoulder,	1	–	Syphilis, Primary,	4	–
,, Elbow,	1	–	,, Secondary,	6	–
Lymphadenoma,	1		,, Tertiary,	16	–
Lymphosarcoma,	1	–			
			Tabes,	1	–
Mania,	1	–	Talipes, Valgus,	2	–
Morbus Coxæ,	13	–	,, Varus,	9	–
			,, Eqrino, Varus,	5	–
			Teno-Synovitis,	2	–
			Testitis,	3	–
Nævus,	2	–	Testicle, Retained,	3	–
Necrosis,	20	–	,, Tubercle of,	2	–
Nephritis,	2	–	Tetanus,	2	2
Neuralgia,	2	–	Tonsillitis,	1	–
			Tumour, Abdominal,	7	–
			,, Cerebral,	1	–
			,, Pharyngeal,	1	–
Onychia,	2	–	,, Malignant of Vocal Cords,	1	–
Orchitis,	1	–	Tuberculosis of Ankle,	3	–
Osteitis,	1	–	,, Elbow,	1	–
Otitis,	3	–	,, Knee,	14	–
			,, Shoulder,	1	–
			,, Acute Miliary,	1	1
Palate, Cleft,	4	–			
Paralysis,	1	–			
Paraphymosis,	5	–			
Paronychia,	7	–	Ulcer,	15	–
Pediculus Capitis,	1	–	,, Umbilical,	1	–
Periostitis,	3	–	,, Varicose,	2	–
Phimosis,	4	–	,, Jacobs,	4	–
Phlebitis,	2	–			
Pneumonia,	1	1			
Polypus nasi,	3	–			
Prolapsus uteri,	1	–	Vaginitis,	1	–
Prostate, enlarged,	7	–	Varicose Veins,	25	1
Pyæmia,	1	–	Varicocele,	3	–
Premature birth,	1	1	Vulvitis,	2	–
Rachitis,	3	–	Wound,	12	–
Ranula,	2	–	,, of Eye,	1	–
Rectum, Prolapse of,	1	–	,, Poisoned,	1	–
Retention of Urine,	1	–	,, Gunshot,	1	–
			Not treated,	10	–
Sciatica,	1	–	Mothers in Charge of Infants,	18	–
Sarcoma,	2	–	Admitted Previous Year,	–	–
Scorbutus,	1	–	Morbus Coxæ and Amyloid Disease,	–	1
Scrofula,	25	–			
Shock,	3	–			

MEATH HOSPITAL, Year ended 31st March, 1894.

Disease.	No. Treated.	No. Died.	Disease.	No. Treated.	No. Died.
Abscess, Acute,	28	–	Debility,	16	–
,, Chronic,	18	–	Delirium tremens,	6	–
Adenitis,	1	–	Diabetes,	2	–
Alcoholism,	13	2	Diarrhœa,	6	1
Amenorrhœa,	2	–	Diptheria,	1	1
Anæmia,	7	–	Dropsy,	7	–
,, Pernicious,	1	–	Dyspepsia,	13	–
Angina Pectoris,	1	–			
Anthrax,	3	2			
Anus, Fistula in,	2	–	Eczema,	10	–
Aortic Valve Disease,	11	3	Empyema,	5	–
Amnesia,	2	–	Emphysema,	3	–
Aphthæ,	1	–	Enteritis,	1	1
Apoplexy,	2	2	Epilepsy,	5	–
Arthritis,	3	–	Epistaxis,	1	–
Asthma,	1	–	Erysipelas,	15	3
			Erythema,	3	–
			,, Nodosum,	1	–
Bromidrosis,	1	–			
Bronchitis, Acute,	17	–			
,, Chronic,	11	2	Fever, Enteric,	54	7
Broncho, Pneumonia,	2	1	,, Simple,	4	–
Bubo,	4	–	,, Typhus,	1	–
Burns and Scalds,	16	3	,, Measles,	1	–
Bursitis,	9	–	Fracture of Clavicle,	3	–
			,, Femur,	14	–
			,, Fibula,	11	–
			,, Frontal,	1	–
Cancer of Axilla,	1	–	,, Hip,	1	–
,, Breast,	10	1	,, Humerus,	7	–
,, Hand,	1	–	,, Nasal bones,	1	–
,, Jaw,	1	–	,, Olecranon,	1	–
,, Lip,	5	–	,, Patella,	2	–
,, Neck,	2	1	,, Radius,	3	–
,, Stomach,	4	3	,, Ribs,	7	–
,, Œsophagus,	4	3	,, Skull,	4	1
Caries of Clavicle,	1	–	,, Tibia,	14	–
,, Foot,	6	–	,, Tibia and Fibula,	4	–
,, Hand,	1	–	Furuncle,	1	–
,, Radius,	1	–			
,, Spine,	1	–			
Catarrh,	16	–	Gangrene,	2	–
Cellulitis,	4	–	Ganglion,	1	–
Cephalagia,	1	–	Gastritis,	16	–
Chancre,	1	–	Gastric Ulcer,	8	1
Chemosis,	1	–	Genu Valgum,	3	–
Chlorosis,	29	–	Genu Varum,	1	–
Chorea,	6	–	Gout,	3	–
Cirrhosis of Liver,	4	–	Gonorrhœa,	2	–
Cleft Palate,	1	–	Graves's Disease,	3	–
Colic,	2	–			
,, Biliary,	1	–			
Colica Pictonum,	1	–	Hæmatemesis,	1	–
Collapse,	1	–	Hæmaturia,	1	–
Coma,	1	–	Hæmoptysis,	4	–
Concussion of Brain,	13	1	Hammer toe,	2	–
,, Spine,	1	–	Hæmorrhoids,	6	–
Conjunctivitis,	1	–	Heart, Disease of,	7	6
Constipation,	15	–	Hemiplegia,	3	–
Contusion	19	–	Hepatitis,	5	–
Convulsions,	4	2	Hiccough,	1	–
Coxalgia,	1	–	Hernia,	18	1
Croup,	3	2	Hydrocele,	2	–
Cystitis,	3		,, of Neck,	1	–

continued.

Appendix — MEATH HOSPITAL—*continued.*

No. 1. *Meath Hospital.*

Disease.	No. Treated.	No. Died.	Disease.	No. Treated.	No. Died.
Hydro-sarcocele,	2	–	Peliosis Rheumaticia,	2	–
Hydrothorax,	3	1	Pemphigus,	1	–
Hypochondriasis,	2	–	Perihepatitis,	2	–
Hysteria,	4	–	Periostitis,	10	1
			Peritonitis,	2	1
			Pertussis,	1	–
			Phimosis,	6	–
Icterus,	6	–	Phlebitis,	4	–
Intestinal Obstruction,	6	2	Phlegmasia dolens,	2	–
Infantile Paralysis,	1	1	Phlagedena,	3	–
Influenza,	18	–	Phthisis pulmonalis,	54	3
Iritis,	1	–	Pleuritis,	13	–
			Pleurodynia	2	–
			Pleuropneumonia,	2	–
			Pneumonia,	27	5
Laryngitis,	4	–	,, typhoid,	1	–
Lateral Sclerosis,	3	–	Polypus nasi,	2	–
Leucorrhœa,	2	–	Prolapsus ani,	2	–
Lumbago,	5	–	,, vagina,	1	–
Lupus,	5	–	Prostate, enlarged,	4	–
Lymphangitis,	5	–	Psoriasis,	2	–
Lymphadenoma,	4	–	Purpura,	2	–
Locomotor Ataxy,	4	–			
Luxation (Hay's),	2	–			
,, of Humerus,	1	–			
,, Knee,	1	–	Rheumatism, Acute,	42	1
,, Ankle,	1	–	,, Chronic,	19	–
,, Clavicle,	1	–			
			Sarcocele,	1	–
Morbus Coxæ,	6	–	Scabies,	1	–
Melæna,	1	–	Sciatica,	9	–
Melancholia,	2	–	Scarlatina,	12	–
Meningitis,	3	3	Sarcoma,	3	–
Mitral Valve, Disease of,	22	1	Septicæmia,	1	–
Multiple nuritis,	2	–	Sprain,	12	–
Molluscum Contagiosum,	2	–	Struma,	12	–
			Stricture of the Œsophagus,	2	–
			,, Urethra,	9	–
			Synovitis,	19	–
Nævus,	1	–	Syphilis, Secondary,	2	–
Narcosis,	1	–	,, Tertiary,	6	–
Necrosis of Femur,	1	–			
,, Inf. Maxilla,	3	–			
,, Tibia,	1	–			
Neurasthenia,	3	–	Tinea Tonsurans,	1	–
Nephritis,	14	2	Tonsillitis,	37	–
Nephritic Abscess,	2	–	Tumour,	12	–
Onychia,	6	–	Ulcer,	51	–
Ophthalmia,	2	–	Urine, Retention of,	4	–
Orchitis,	4	–	,, Incontinence of,	2	–
Osteo-Sarcoma,	1	–	Urethra, Rupture of,	1	–
Osteitis,	1	–			
Otorrhœa,	1	–			
			Varix,	10	–
			Varicocele,	4	
Paralysis,	3	–			
Paraphymosis,	1	–			
Paronychia,	3	–	Wounds,	41	–

STEEVENS'S HOSPITAL, Year ended 31st March, 1894.

Disease.	No. Treated	No. Died.	Disease.	No. Treated	No. Died.
Abortion,	3	–	Fracture of Thumb,	2	–
Abscess,	74	1	,, Femur,	5	–
Alcoholism,	7	–	,, Rib,	3	–
Amputations,	14	–	,, Scapula,	2	–
Asthenia,	6	1	,, Humerus,	3	–
Adenitis,	2	–	,, Toe,	2	–
Amenorrhœa,	1	–	,, Pelvis,	3	–
Anæmia,	14	1	,, Patella,	1	–
Anthrax,	6				
Aphonia,	1	–	Gangrene of Foot,	2	–
Apoplexy,	2	2	,, Toe,	1	–
Arthritis,	4	–	,, Hand,	1	1
Asthma,	1	–	Genu Vulgum,	1	–
			Goitre,	3	–
Bronchitis, Acute,	34	1	Gastritis,	13	–
,, Chronic,	4	2	Gonorrhœa,	7	–
Bubo,	9	–			
Burns and Scalds,	22	5	Hæmoptysis,	6	–
			Hernia,	4	–
Bursitis,	2	–	Hæmorrhoids,	11	–
			Heart, Disease of,	17	1
Calculus in Bladder,	1	–	Hepatitis,	1	–
Cancer of Epithelioma of Nose,	2	–	Hernes,	2	–
			Hydrocele,	2	–
,, Epithelioma of Breast,	3	–	Hysteria,	3	–
,, Epithelioma of Lip,	4	–	Influenza,	19	–
Caries, of Tarsus,	1	–	Iritis,	3	–
Cataract,	5	–			
Catarrh,	53	1	Laryngitis,	6	–
Chancre,	23	–	Lumbago,	1	–
Chorea,	4	–	Luxation of Ankle,	1	–
Colic,	12	–	,, Finger,	1	–
Concussion of Brain,	6	–	,, Shoulder,	7	–
Conjunctivitis,	10	–			
Constipation,	6	1	Mania,	2	–
Cramps,	2	–	Morbus Coxæ,	5	–
Croup,	4	–	Meningitis.	1	1
Cystitis,	2	–	Menorrhagia,	1	–
Delirium Tremens,	1	1	Nævus,	4	–
Diabetes,	5	–	Necrosis,	8	–
Diarrhœa,	12	–	Nephritis,	5	1
Diphtheria,	3	1	Neuralgia,	9	–
Dropsy, Cardiac,	3	1	Neuroma,	1	–
Dyspepsia,	6	–			
			Orchitis,	3	–
Eczema,	15	–	Osteitis,	1	–
Empyema,	5	–			
Enteritis,	7	–			
Epilepsy,	5	–	Paralysis,	9	1
Epistaxis,	2	–	Pyæmia,	1	1
Erysipelas,	22	1	Paraphymosis,	1	–
Epididymitis,	1	–	Paraplegia,	2	–
			Parulis	1	–
Fever, Enteric,	33	5	Periostitis,	2	–
,, Simple continued,	7	–	Peritonitis,	4	2
,, Typhoid,	6	–	Pertussis,	5	1
Fistula in Ano,	6	–	Phlebitis,	2	–
,, Side,	1	–	Phthisis pulmonalis,	29	4
Fracture of Leg,	23	–	,, Laryngæ,	1	1
,, Clavicle,	2	–	Pleuritis,	7	–
,, Forearm,	5	–	Pneumonia,	24	7

[*continued.*

Appendix.

No. 1.

Steevens's Hospital.

STEEVENS'S HOSPITAL—*continued.*

Disease.	No. Treated.	No. Died.	Disease.	No. Treated.	No. Died.
Psoriasis,	2	–	Syphilis, Primary,	9	–
Pharyngitis,	3	–	,, Secondary,	10	–
Phagedæna,	1	–	,, Tertiary,	4	–
Rachitis,	5	–			
Ranula,	1		Tonsillitis,	52	–
Rheumatism, Acute,	65	–	Tumours,	13	–
,, Chronic,	3	–	,, Ovarian,	1	–
Rubeola,	19	–	Tuberculosis of Larynx,	1	–
Scabies,	3	–			
Sciatica,	2	–	Urine, Incontinence of,	2	–
Scarlatina,	30	1			
Spermatorrhœa,	1	–	Varicella,	3	–
Sprain,	10	–	Varix,	30	–
Spine, Curvature of,	1	–			
Stricture of Urethra,	9	–			
Synovitis,	6	–	Wounds,	120	1

Rotunda Lying-in Hospital.

THE LYING-IN (ROTUNDA) HOSPITAL.

RETURN of DISEASES treated in GYNÆCOLOGICAL (AUXILIARY) WARDS during year ended 31st March, 1894.

Abdominal sinus,	3	–	Infundibuliform Pelvis,	1	–
,, Tumour,	5	–			
Abortion,	11	–	Keloid,	1	–
Abscess,	2	–			
Adherent Tubes & Ovaries,	5	–			
,, uterus,	1	–	Lacerated Cervix,	19	–
Antiflexion,	2	–	,, Perineum,	11	–
Ascites,	1	–	Laceration of Vulva,	28	–
			Leucorrhœa,	2	–
Bright's Disease,	1	–			
Cystitis,	3	–	Malignant Disease,	19	
			Mastitis,	4	
Dermoid Cyst,	6	–			
Dextroversion,	2	–			
Double Uterus, Vagina absent,	1	–	Melancholia,	1	
Dysmenorrhœa,	4	–	Menorrhagia,	4	–
			Mole,	1	–
			Myoma,	35	–
Ectropion,	5	–	Myxœdema,	1	–
Emansio Mensium,	1	–			
Endometritis,	94	–	Ovarian Tumour,	11	–
Enlarged Ovaries,	1	–			
Epilepsy,	1	–	Parametritis,	4	–
			Parovarian Tumour,	1	–
Fibro Cystic Tumour,	1	–	Perimetritis,	6	–
Floating Kidney,	1	–	Phagedæna,	1	–
			Polypus,	12	–
Granular Erosion,	7	–	Pregnancy,	10	–
			Prolapse of Rectum,	1	–
Hæmatocele,	3	–	,, Urethra,	1	–
Hæmorrhoids,	2	–	,, Uterus,	16	–
Hysteria,	2	–	Puerperal Mania,	1	–
			,, Ulcer,	1	–
Infantile uterus,	1	–	Pyo-salpinx,	7	–

[*continued*

ROTUNDA LYING-IN HOSPITAL—*continued.*

Disease.	No. Treated.	No. Died.	Disease.	No. Treated.	No. Died.
Rectocele,	1	–	Vaginal Cyst,	1	–
Retention Cyst in Vagina,	1	–	Vaginismus,	1	–
Retroflexion,	6	–	Vaginitis,	5	–
Retroversion,	70	–	Varicose Veins,	1	–
			Vesico-vaginal Fistula,	1	–
Salpingitis,	6	–			
Secondary Haemorrhage,	1	–	Umbilical Hernia,	1	–
Stenosis of external os,	7	–	Urethral, Caruncle,	1	
Stricture of Rectum,	1	–			
Syphilis,	1	–	Remaining under treatment	22	–
Tubercular Peritonitis,	4	–	Unclassified,	5	–

RETURN showing number of DEATHS in "LABOUR" and "GYNÆCOLOGICAL" (Auxiliary) WARDS respectively, during year ended 31st March, 1894; exhibiting also other requested Particulars.

	LABOUR DEPARTMENT.				GYNÆCOLOGICAL DEPARTMENT.			CAUSE OF DEATH.
	Register No.	Admitted.	Delivered.	Died.	Reg. No.	Admitted.	Died.	
I.	—	—	—	—	6,679	30. 3.93	7. 4.93	Tubercular Peritonitis Fœcal Fistula.
II.	283,190	7. 4.93	7. 4.93	9. 4.93	—	—	—	Septicæmia.
III.	—	—	—	—	6,655	17. 3.93	11. 4.93	Tubercular Peritonitis Fœcal Fistula Marasmus.
IV.	283,165	11. 4.93	8. 4.93	21. 4.93	—	—	—	Pulmonary, Embolism.
V.	—	—	—	—	6,755	25. 5.93	31. 5.93	Sapræmia.
VI.	283,552	31. 5.93	1. 6.93	1. 6.93	—	—	—	Myoma Post-partum Hæmorrhage.
VII.	—	—	—	—	6,590	27. 1.93	14. 6.93	Tuberculosis.
VIII.	283 648	19. 6.93	19. 6.93	19. 6.93	—	—	—	Mitral Stenosis Collapse.
IX.	—	—	—	—	6,779	12. 6.93	27. 6.93	Myoma Peritonitis.
X.	283,675	24. 6.93	24. 6.93	1. 7.93	—	—	—	Cerebro-Spinal Meningitis.
XI.	283,678	25. 6.93	25. 6.93	14. 7.93	—	—	—	Septicæmia.
XII.	283,800	18. 7. 9	Not Delivered.	18. 7.93	—	—	—	Rupture of Symphysis, Septicæmia.
XIII.	—	—	—	—	6,817	7. 7.93	25. 7.93	Cancer of Ovary, Shock.
XIV.	283,820	24. 7.93	24. 7.93	29. 7.93	—	—	—	Septicæmia.
XV.	283,864	31. 7.93	—	9. 8.93	—	—	—	Uræmia.
XVI.	284,889	24. 8.93	24. 8.93	26. 8.93	—	—	—	Peritonitis.
XVII.	—	—	—	—	6,889	7. 9.93	14. 9.93	Myoma, Shock.
XVIII.	—	—	—	—	6,857	21. 8.93	26. 9.93	Pyosalpynx, Septicæmia.
XIX.	284,415	30. 8.93	No Delivery.	30. 9.93	—	—	—	Accidental Hæmorrhage.
XX.	284,526	25. 9.93	25. 9.93	12.10.93	—	—	—	Phthisis.
XXI.	—	—	—	—	6,894	9. 9.93	16.10.93	Double Uterus Abdomni Section, Septicæmia.
XXII.	284,602	13.10.93	16.10.93	20.10.93	—	—	—	Mania.
XXIII.	—	—	—	—	6,941	11.10.93	20.10.93	Cancer of Uterus, Septicæmia.
XXIV.	284,679	29.10.93	29.10.93	10.11.93	—	—	—	Saprœmia.
XXV.	284,763	13.11.93	15.11.92	20.11.93	—	—	—	Bright's Disease.
XXVI.	—	—	—	—	6,702	11. 4.93	14.12.93	Tubercular Peritonitis, Asthenia.
XXVII.	—	—	—	—	6,995	7.12 93	3. 1.94	Double Salpyngitis, Peritonitis.
XXVIII.	284,929	20.12.93	29.12.93	6. 1.94	—	—	—	Septicæmia.
XXIX.	—	—	—	—	7,016	7. 1.94	21. 1.94	Double Salpynigitis, Erysipelas.
XXX.	—	—	—	—	7,054	29. 1.94	5.11.94	Colporraphy, Erysipelas.
XXXI.	285,286	19. 2.94	19. 2.94	24.11.94	—	—	—	Pleuro-pneumonia.
XXXII.	—	—	—	—	7,020	9. 1.94	8.11.94	Carcinoma Uteri, Erysipelas.
XXXIII.	—	—	—	—	7,100	7. 3.94	24. 3.94	Hystirectomy Peritonitis.
Total,	17	—	—	—	16	—	—	

Appendix.

No. 1.

Coombe Lying-in Hospital.

Coombe Lying-in Hospital.

Return of Diseases treated during the Year ended 31st March, 1894.

Chronic Wards.

Abscess, Iliac,	1	Myelitis,	1
,, Ischio-rectal,	1	Myomata,	5
,, of Labium,	1	Menorrhagia,	4
,, Mammary,	6		
,, Multiple,	1		
Abortions,	11	Ovaritis,	4
,, Incomplete,	20		
Amenorrhœa,	1		
Anteversion and Anteflexion,	7	Parametritis Posterior,	4
Ascitis, with Cirrhosis of Liver,	1	Perimetritis,	2
		Peritonitis,	2
		Pleurisy and Perihepatitis,	1
Carcinoma of Cervix,	5	Pneumonia,	1
,, Abdomen,	1	Pregnancy,	7
,, Fundus,	6	,, with Deformed Pelvis,	1
,, Breast,	1	Prolapse of Rectum,	2
Calculus Vesical,	1	,, Uterus and Vagina,	5
Caruncle of Urethra,	1	Pyosalpinx,	2
Cellulitis,	16		
,, Anterior,	3		
Cervix, Laceration of,	4	Retroversion Adherent,	3
Chlorosis,	1	,, and Retroflexion,	16
Coccyx, Fracture of,	1		
Cyst of Labium,	1		
,, Broad Ligament,	2	Salpingo-oophoritis,	1
Cystitis,	1	Salpingitis,	1
		Stenosis of Cervix,	5
		Sterility,	2
Dysmenorrhœa,	4	Subinvolution,	2
Dyspareunia,	1	Syphilis and Gonorrhœa,	3
		,, with Ulcer of Labium,	1
Emesis (of Alcoholism),	1	Urine, Retention of,	2
Fissured Nipples,	1	Vesico-Vaginal Fistula,	1
		Vaginitis and Vulvitis,	3
Hæmatoma,	2	Vulva Eczema and Pruritus of,	3
Hæmorrhage (Accidental),	1	Various,	16
Hæmorrhoids,	1	Unclassed,	31
Hemiplegia,	1		
Hepatic Tumour,	1		
Hernia (Ventral),	2	Wounds of Labia,	2
Hymen Imperforate,	2	,, Vagina,	1
Hysteria,	2		
Laceration of Perinæum,	1		
Metritis and Endometritis,	41	Remaining in Hospital on 1st April, 1894,	8
Metrorrhagia,	11		

Appendix No. 1.

RETURN showing NUMBER of DEATHS in LABOUR WARDS, during the year ended 31st March, 1894, with other requested Particulars.

Coombe Lying-in Hospital.

No.	Labour Register No.	Age, Years.	Date of Admission.	Date of Delivery.	Date of Death.	Cause of Death.
			1893.	1893.	1893.	
1	20	30	18 April,	18 April,	25 April,	Peritonitis.
2	29	26	28 April,	28 April,	30 April,	Operation, Peritonitis.
3	86	30	28 June, .	28 June, .	7 July, .	Embolism, Syncope.
4	239	4	13 Dec., .	13 Dec., .	13 Dec., .	Unavoidable Hæmorrhage, and Syncope.

RETURN showing NUMBER of DEATHS in CHRONIC WARDS, during the year ended 31st March, 1894, with other requested Particulars.

No.	Chronic Register No.	Age, Years.	Date of Admission.	Date of Death.	Labour Register No.	Date of Delivery within one month *ante* Death.	Cause of Death.
			1893.	1893.			
1	52	27	8 June, .	22 July, .	—	—	Abdominal Section, Septic Peritonitis, Syncope.

ROYAL HOSPITAL FOR INCURABLES, Year ended 31st March, 1894.

Royal Hospital for Incurables.

Disease.	No. Treated.	No. Died.	Disease.	No. Treated.	No. Died.
Aneurism of Descending Aorta.	1	–	Heart, Disease of, . .	21	2
Angina Pectoris, .	1	–	Hemiplegia, . .	21	6
Ankylosis of Hip, Knee, and Ankle.	1	–	Hydrocephalus, . .	1	–
Arthritis, . . .	4	–	Laryngitis, . .	1	–
Asthma, . . .	1	–	Lupus of Face, . .	7	–
Bronchitis, Chronic, .	7	–	Morbus Coxæ, .	3	–
Broncho-pnemonia, .	1	–	Necrosis of Femur, .	1	–
Cancer of Stomach, .	2	–	Nephritis, . . .	2	–
,, Breast, . .	7	5	Paralysis, Agitans, .	1	1
,, Throat, . .	8	4	,, Spinal, . .	12	2
,, Rectum, .	1	–	Paraplegia, . .	10	–
,, Uterus, . .	8	4	Phthisis Pulmonalis, .	37	14
,, Gut, . .	1	1	Rachitis, . . .	1	–
Caries of Bones of Leg, .	4	2	Rheumatism, Chronic, .	25	1
,, Spine, . .	2	–	Scrofula, . .	3	–
,, Pelvis, . .	1	–	Spine, Disease of Bones of,	10	–
Chorea, . . .	1	–	Tabes, Dorsalis, . .	4	–
Gastritis, . . .	1	–	Tuberculous, . .	2	–
Hernia, . . .	1	–	Tumour of Uterus, .	5	–
Hæmorrhoids, . .	2	–	Uterus, Prolapse of, .	3	–
			Ulcer, Grastic, . .	2	–
			,, of Legs, . .	2	–

Appendix.

No. 1.

Cork-street Fever Hospital.

CORK-STREET FEVER HOSPITAL, Year ended 31st March, 1894.

Disease.	No. Treated.	No. Died.	Disease.	No. Treated.	No. Died.
Abscess,	7	1	Laryngitis,	4	2
Adenitis,	1	–	Lumbago,	2	–
Ague,	1	–			
Anæmia,	4				
Anthrax,	1	–	Marasmus,	3	1
Aphthæ,	1	–	Measles,	254	27
Asthema,	5	2	Meningitis,	12	11
Asthma,	1	–	Migraine,	1	–
			Minoers,	60	–
Bronchitis, Acute,	37	4			
Bursitis,	6	–	No disease,	2	–
			Not suitable,	9	–
			Nephritis,	3	1
Cancer of Stomach,	1	–			
Carditis,	4	1			
Cellulitis,	4	1	Observation,	24	–
Cephalalagia,	1	–	Ophthalmia,	3	–
Cerebrospinal Meningitis,	1	–			
Cholerine,	15	2			
Colic,	5	–			
Colitis,	2	–	Paronychia,	1	–
Constipation,	15	–	Parotitis,	1	–
Convulsions,	1	–	Parulis,	1	–
			Periostitis,	1	–
			Peritonitis,	4	2
			Pertussis,	11	1
Delirium tremens,	11	–	Phthisis pulmonalis,	11	4
Diarrhœa,	6	1	Pleuritis,	9	–
Diphtheria,	19	6	Pleurodynia,	4	–
Dropsy,	2	1	Pneumonia,	125	13
Dysentery, acute,	1	–	Puerperal Fever,	2	–
Eczema,	4	–			
Elephantiasis,	1	1	Rhinitis,	1	–
Empyema,	2	–	Rheumatism, Acute,	36	1
Emesis,	1	–	Rötheln,	21	–
Enteritis,	1	–			
Emergency,	1	–			
Erysipelas,	194	15	Scabies	1	–
Erythema,	1	–	Scarlatina,	246	12
			,, Convalescent,	8	–
			Scorbutus,	1	–
Fever, Simple,	28	–	Septic Fever,	11	4
,, Typhus,	7	2	Syncope,	1	–
,, Enteric,	260	20	Synovitis,	1	–
			Syphilis, Secondary,	1	–
Gastritis,	2	–			
			Tabes Mesenterica,	10	–
			Tuberculosis,	6	5
Hæmatemesis,	3	–	Tonsillitis,	48	–
Hepatitis,	2	1	Typhlitis,	1	–
Hypochondriasis,	1	–			
			Ulcerated Throat,	6	–
			Urticaria,	3	–
Infante,	4	–			
Injury,	1	–			
Influenza,	33	–	Vaccinia,	5	–

WESTMORLAND LOCK HOSPITAL, Year ended 31st March, 1894.

Disease.	No. Treated.	No. Died.	Disease.	No. Treated	No. Died
Abscess,	10	–	Lepra, Syphilitic,	5	–
Adenitis, Multiple,	9	–	Leucorrhœa,	21	–
Abrasions,	2	–	,, and Phthisis,	1	1
Alcoholism,	4	–	Lupus, Syphilitic,	1	–
Acne, Syphilitic,	5	–	Laryngitis, Syphilitic,	2	–
Adenitis,	3	–			
Anæmia,	6	–			
			Menorrhagia,	2	–
Bronchitis, Acute,	4	–	Necrosis, Syphilitic,	1	–
Bubo,	20	–			
			Ophthalmia,	3	–
Caries, Syphilitic,	1	–	,, Gonorrhœa,	3	–
Chancroid,	81	–	Ovaritis,	5	–
Chancre,	35	1			
Colic,	1	–			
Contusion,	1	–	Paralysis, Facial,	1	–
Condyloma,	22	–	Phagedæna,	3	–
Cynanche,	6	–	Periostitis, Syphilitic,	3	–
			Phthisis pulmonalis,	3	2
			Pleurodynia,	2	–
			Pneumonia,	1	–
Dysuria,	4	–	Pediculi,	1	–
			Porrigo, Syphilitic,	2	1
			Prolapsus ani, Artificialis,	1	–
			,, uteri,	1	–
Ecthyma, Syphilitic,	3	–	Psoriasis,	8	–
Eczema,	3	–	Prurigo,	1	–
Epilepsy,	1	–			
Erysipelas,	3	–			
Erythema,	1	–			
Excoriation,	12	–	Rheumatism Syphilitic,	12	–
			Roseola, Syphilitic,	1	–
			Rupia, Syphilitic,	9	–
Fissure,	9	–			
			Scabies,	7	–
			Sprain,	2	–
Gangrene of Gut,	8	–	Syphilis, Congenital, and		
Gonorrhœa,	125	1	Gonorrhœa, Ophthalmia,	1	1
			Syphilis, Congenital,	12	6
			,, Primary,	61	–
Hæmorrhoids,	4	–			
Heart Disease, Valvular and pregnancy,	1	1	Ulcer,	13	–
Hemiplegia,	1	–	,, Tertiary,	1	1
Hepatitis,	1	–	,, Non Specific,	5	–
Herpes, Zoster Syphilitic,	1	–			
Hysteria,	2	–			
Hypertrophied Labia,	11	–	Venereal Disease and Pregnancy,	15	–
			Vulvitis,	7	–
Ichthyosis, Syphilitic,	1	–			
Influenza,	1	–	Warts, Venereal,	21	–
Iritis, Syphilitic,	5	–	Vaginitis,	1	–

Appendix.

No. 1.

St. Mark's Ophthalmic Hospital.

St. Mark's Ophthalmic Hospital.

Abstract of the Diseases affecting 747 In-Patients treated in the Wards of the Hospital, and affecting the New Out-Patients treated at the Dispensary of the Institution, during the year ended 31st March, 1894.

Diseases of the Eye.	Out-Patients.			In-Patients.			Gross Total.			Operations.		
	M.	F.	Total	M.	F.	Total	M.	F.	Total.	M	F.	Total
Palpebrae,	255	201	456	26	23	49	281	224	505			
Conjunctiva,	748	645	1,393	62	49	111	810	694	1,504			
Cornea,	350	313	663	111	80	191	461	393	854			
Sclerotica,	3	3	6	17	-	17	20	3	23			
Uvea A. Iris,	95	51	146	67	35	102	162	86	248			
B. Chorioidae et Corpus Ciliare,	29	13	42	7	2	9	36	15	51			
Corpus Vitreum,	8	7	15	3	–	3	11	7	18			
Retina et Nervus Opticus,	45	15	60	23	7	30	68	22	90			
Glaucoma,	7	6	13	15	8	23	22	14	36			
Bulbus,	13	10	23	38	12	50	51	22	73			
Lens,	74	66	140	82	40	122	156	106	262			
Refractio,	133	193	326	5	6	11	138	199	337			
Accommodatio,	24	26	50	–	–	–	24	26	50			
Musculi et Nervi,	55	45	100	11	12	23	66	57	123			
Orbita,	2	3	5	–	1	1	2	4	6			
Organa Lachrymalia,	15	29	44	1	4	5	16	33	49			
Total,	1,856	1,626	3,482	468	279	747	2,324	1,905	4,229			
Diseases of the Ear and Various.												
Auricle and Meatus,	246	180	426	1	4	5	247	184	431			
Tympanum,	327	312	639	13	20	33	340	332	672			
Labyrinth,	16	17	33	–	1	1	16	18	34			
Nasus,	3	2	5	2	2	4	5	4	9			
Pharynx et Larynx,	10	12	22	1	–	1	11	12	23			
Various and unknown (Eye and Ear),	–	–	–	–	6	6	–	6	6			
Total,	602	523	1,125	17	33	50	619	556	1,175			
Total Eye, Ear, and Various Diseases for year 1893-94,	2,458	2,149	4,607	485	312	797	2,943	2,461	5,404			

Appendix.

No. 2.

Average cost per Bed, 1894.

TABLE No. 2, showing the AVERAGE COST per BED occupied throughout the year ended 31st MARCH, 1894, for MAINTENANCE, and for ESTABLISHMENT, and for both, exclusive of Buildings and furnishing such Buildings.

NAME OF HOSPITAL.	Average daily number of Beds occupied throughout the year.	Average annual cost per bed for *Maintenance.	Average annual cost per bed for †Establishment, exclusive of buildings and furnishing such buildings.	Average annual cost per bed for Maintenance and for Establishment, exclusive of buildings and furnishing such buildings.
		£ s. d.	£ s. d.	£ s. d.
Westmorland Lock, . .	76·	13 19 1¾	23 13 9	37 12 10¾
Steevens's, ...	88·15	29 1 11¾	35 0 4½	64 2 4¼
Meath, ...	88·84	21 1 1½	29 16 9½	50 17 10¾
Cork-street Fever, . . .	108·08	20 15 10¼	37 16 10	58 12 8¼
House of Industry, . . .	126·62	17 14 9	41 15 1¼	59 9 10¼
Rotunda Lying-in, . . .	61·57	20 10 6¼	52 6 5¼	72 16 11½
Coombe do., ...	18·44	20 18 8½	50 10 1½	71 8 9¾
Incurables, ...	179·83	18 8 8	12 18 6¼	31 7 2¼
St. Mark's, ...	45·48	15 6 7½	20 1 9½	35 8 5

* Maintenance comprises provisions, groceries, alcoholic stimulants, drugs, leeches, surgical instruments, medical appliances, and clothing of patients.

† Establishment charges include salaries of officers, wages of servants, rations of officers and servants, clothing of servants, rent, taxes, insurance, soap, candles, fuel, gas-light, furniture, repairs, straw, bedding, utensils, buildings, and furnishing such buildings, stationery, printing, advertising burials, coffins, pensions, incidentals, and laundry expenses.

Appendix.

No. 3.

Expenses of Hospitals.

TABLE No. 3, showing in detail the several CHIEF HEADS of EXPENDITURE of and to Establishment, and the

NAME OF HOSPITAL.	EXPENDITURE FOR MAINTENANCE FOR						
			Stimulants.				
	Provisions.	Groceries.	Wine.	Whiskey, Brandy, &c.	Ale and Porter.	Drugs and Leeches.	Surgical Instruments and other Medical and Surgical Appliances.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Westmorland Lock,	644 12 9	59 3 10	24 1 2	31 16 2	36 8 4	229 19 6	13 14 9
Steevens's,	1,582 11 3	194 9 11	38 18 0	103 15 11	41 18 6	412 2 8	191 6 2
Meath,	1 182 14 7	87 11 11	11 12 0	37 7 5	17 12 0	371 4 4	162 8 10
Cork-street,	1,330 11 8	354 11 1	43 4 0	75 16 1	45 11 9	187 9 0	45 17 7
House of Industry,	1,351 6 6	107 2 5	24 3 0	60 9 9	15 1 7	344 1 5	315 0 6
Rotunda Lying-in,	746 8 2	60 12 2	–	48 0 10	–	198 4 6	202 9 5
Coombe do.	200 3 0	30 12 9	1 16 0	3 16 3	–	128 8 2	21 4 9
Incurables,	2,380 5 9	352 17 0	46 7 0	145 11 4	49 6 8	93 1 1	41 11 4
St. Mark's,	488 0 9	45 0 5	–	1 4 6	–	110 15 1	52 4 9
Totals,	9,926 14 5	1,292 1 6	190 1 2	507 18 3	205 18 10	2,075 5 9	1,045 18 1

NAME OF HOSPITAL.	EXPENDITURE FOR ESTABLISHMENT FOR						
	Rent, Taxes, and Insurance.	Soap and Candles.	Coals and other Fuel, and Gas-light.	Furniture and Repairs.	Straw, Bedding, and Utensils.	Buildings, and Furnishing such Buildings.	Stationery, Printing and Advertising.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Westmorland Lock,	24 1 8	42 19 7	320 16 4	47 12 2	8 12 2	107 8 1	29 6 11
Steevens's,	90 1 6	58 18 9	438 1 8	166 10 4	306 3 4	265 0 4	105 15 11
Meath,	50 13 4	113 9 9	374 15 8	264 17 11	–	783 8 2	63 4 2
Cork-street,	144 4 2	97 12 10	365 11 1	763 1 7	–	215 17 2	71 4 3
House of Industry,	436 19 0	121 18 3	621 2 6	205 1 6	101 13 5	c1,002 15 3	72 16 9
Rotunda Lying-in,	82 17 9	53 12 0	385 4 1	253 16 3	107 12 9	293 4 0	149 15 2
Coombe do.	90 1 0	4 10 10	121 7 3	29 17 6	36 2 9	–	38 10 10
Incurables,	107 12 3	–	527 17 9	99 0 2	108 11 8	121 17 7	96 0 2
St. Mark's,	37 9 7	15 16 5	103 10 2	49 11 2	32 10 6	189 16 7	68 3 3
Totals,	1,064 0 3	508 18 5	3,458 6 6	1,379 8 7	701 6 7	2,979 7 2	694 17 5

(*a*) This includes Vartry Water £45 19*s.* 4*d.*, and Telephone £18 7*s.* 6*d.* (*b*) Includes Clothing. Interest. (*c*) Includes

each HOSPITAL, in the Year ended 31st March, 1894, in respect to Maintenance, Total Expenditure for Maintenance.

Clothing of Patients.	Total Maintenance.	Expenditure for Establishment for: Salaries of Officers.	Wages of Servants.	Rations of Officers and Servants.	Clothing of Servants.	Name of Hospital.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
0 18 9	1,060 15 3	717 11 10	287 0 0	145 5 1	35 8 9	Westmorland Lock.
–	2,565 2 5	515 2 0	616 11 2	671 10 0	–	Steevens's.
–	1,870 11 1	388 1 4	508 10 0	523 3 4	67 13 2	Meath.
164 5 3	2,247 6 5	675 17 2	5936 0 3	659 0 11	–	Cork-street.
28 16 0	2,246 1 2	1,024 16 3	1,067 9 9	1,104 17 4	105 9 6	House of Industry.
8 1 4	1,263 16 5	600 13 4	413 3 6	781 14 5	33 8 11	Rotunda Lying-in.
–	386 0 11	112 10 0	136 2 5	150 10 0	12 18 11	Coombe do.
206 1 6	3,315 1 8	616 8 4	655 4 7	–	–	Incurables.
–	697 5 6	189 10 9	141 1 6	113 19 11	11 3 5	St. Mark's.
408 2 10	15,652 0 10	4,840 11 0	4,761 3 2	4,150 0 11	266 2 8	Totals.

Expenditure for Establishment for: Burials and Coffins.	Pensions.	Incidentals.	Laundry Expenses.	Total Establishment.	Total Expenditure.	Name of Hospital.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
7 19 4	21 4 8	12 6 10	–	1,807 13 5	2,868 8 8	Westmorland Lock.
–	–	118 5 0	–	3,352 0 0	5,917 2 5	Steevens's.
19 7 3	70 0 0	*a*207 3 1	–	3,434 7 2	5,304 18 3	Meath.
34 10 6	18 4 0	124 14 10	–	4,305 18 9	6,553 5 2	Cork-street.
10 2 0	314 12 0	100 6 0	–	6,289 19 5	8,536 0 7	House of Industry.
23 11 3	80 0 0	47 1 7	209 0 0	3,514 15 0	4,778 11 5	Rotunda Lying-in.
–	–	*d*108 13 9	90 0 0	931 5 3	1,317 6 2	Coombe do.
16 17 6	–	*c*96 18 6	–	2,446 8 6	5,761 10 2	Incurables.
–	–	48 2 0	102 15 5	1,103 10 8	1,800 16 2	St. Mark's.
112 7 10	504 0 8	863 11 7	401 15 5	27,185 18 2	42,837 19 0	Totals.

(*c*) Includes £640 balance of Contract Works, Hardwicke Hospital. (*d*) Includes £65 8*s.* 11*d.* Bank £63 10*s.* 8*d.* Water Bill.

Table No. 4.

Showing the several Sources of Income of each Hospital, in the Year ended 31st March, 1894.

Name of Hospital.	Income from															
	Government Grants.	Treasury Receipts under County Infirmary Acts.	Subscriptions and Donations.	Bequests.	Interest on Property.	Assessments on County of Dublin.	Assessments on City of Dublin.	House, Landed, or other Property.	Pay Patients.	Female Pupils.	Charity Sermons	Annuities.	Profits from Rotunda Rooms and Garden, &c.	Government Stocks sold.	Incidentals.	Total Income.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Westmorland Lock,	2,600 0 0	–	–	–	–	–	–	–	–	–	–	–	–	–	a355 8 0	2,955 8 0
Steevens's,	1,300 0 0	–	420 6 0	–	260 7 0	–	150 0 0	2,287 4 2	1,414 8 1	156 0 0	79 6 0	–	–	–	284 15 4	6,302 6 7
Meath,	600 0 0	86 10 0	1,187 5 8	30 0 0	545 10 10	1,000 0 0	300 0 0	547 11 9	448 8 6	–	490 3 6	–	–	–	4 9 4	5,239 19 7
Cork-street,	2,500 0 0	–	512 7 6	72 0 9	1,087 10 11	–	200 0 0	217 18 11	231 1 0	–	75 14 1	29 13 9	–	–	59 9 2	4,985 16 1
House of Industry,	7,472 15 9	–	25 0 0	–	115 7 3	–	–	–	1,160 2 2	–	–	–	–	–	199 15 1	8,883 0 3
Rotunda Lying-in,	700 0 0	–	809 19 1	172 16 7	354 3 3	–	250 0 0	348 16 2	480 18 6	1,145 9 0	166 4 11	–	258 8 10	–	191 15 2	4,378 11 6
Coombe do.	200 0 0	–	349 16 11	–	187 15 8	–	500 0 0	–	9 17 6	149 2 0	83 16 9	–	–	–	–	1,480 8 10
Incurables,	250 0 0	43 5 0	1,343 7 6	1,324 16 7	3,863 11 2		b450 0 0	60 19 0	–	–	–	–	–	–	24 16 3	7,360 15 6
St. Mark's,	100 0 0	–	378 13 10	180 0 0	245 2 9	–	150 0 0	–	711 8 7	–	92 11 11	–	–	–	6 17 2	1,864 14 3
Total,	15,722 15 9	129 15 0	5,026 16 6	1779 13 11	6,659 8 10	1,000 0 0	2,000 0 0	3,462 10 0	4,456 4 4	1,450 11 0	987 17 2	29 13 9	258 8 10	–	987 5 6	43,951 0 7

(a) Includes £350 from War Office.

(b) Includes £100 Special Assessment

TABLE No. 5, showing the Number of PATIENTS treated in each INSTITUTION under the Supervision of the Board of Superintendence of Dublin Hospitals, in the Year ended 31st March, 1894; the Mortality in each; the Average Daily Number in Hospital during the Year; and the present extent of Accommodation for each class of Patients.

NAME OF HOSPITAL.	Number of Patients Admitted, Discharged, Died, &c.										Present Bed Accommodation for								
	Number remaining on the 1st April, 1893.	Admitted in the year ended 31st March, 1894.	Discharged in the year.	Died in the year.	Remaining on the 31st March, 1894.	Total under treatment in the year.	Total treated to a termination.	Average daily number of Beds occupied through the year.	Average number of Days spent in Hospital by each under treatment.	Mortality per cent. on the total treated to a termination.	Fever Patients.	Other Medical Patients.	Surgical Patients.	Syphilitic and Gonorrhœal Patients.	Lying-in Hospital Patients.		Incurable Patients.	Ophthalmic Patients.	Total Bed Accommodation.
															Labour Patients.	Chronic Female Diseases.			
Westmorland Lock,	71	(a) 647	634	15	69	718	649	76·00	38·61	2·31	–	–	–	80	–	–	–	–	80
Steevens's,	87	1,266	1,190	47	116	1,353	1,237	88·15	23·78	3·79	20	54	141	15	–	–	–	–	230
Meath,	94	1,273	1,201	71	95	1,367	1,272	88·84	23·72	5·58	14	37	64	–	–	–	–	–	115
Cork-street Fever,	78	1,656	1,510	146	78	1,734	1,656	108·08	22·75	8·81	120	–	–	–	–	–	–	–	120
House of Industry:																			
Hardwicke,	37	580	539	55	23	617	594	39·83	23·56	9·25	120	–	–	–	–	–	–	–	120
Whitworth,	34	541	496	45	34	575	541	34·84	22·12	8·31	–	82	–	–	–	–	–	–	82
Richmond,	62	(b) 703	688	23	54	765	711	51·94	24·78	3·23	–	–	120	–	–	–	–	–	120
Rotunda Lying-in:																			
Labour Wards,	27	1,772	(c) 1,746	17	36	1,799	1,419	35·21	7·14	1·19	–	–	–	–	70	–	–	–	70
Chronic do.,	32	447	441	16	22	479	457	26·36	20·08	3·5	–	–	–	–	–	35	–	–	35
Coombe Lying-in:																			
Labour Wards,	8	472	(d) 46	4	13	480	358	9·42	6·86	1·11	–	–	–	–	41	–	–	–	41
Chronic do.,	10	241	242	1	8	251	243	9·02	13·69	0·41	–	–	–	–	–	24	–	–	24
Incurables,	183	48	(e) 7	44	180	231	51	179·83	284·15	86·27	–	–	–	–	–	–	180	–	180
St. Mark's,	50	689	694	–	45	739	694	45·48	22·46	–	–	–	–	–	–	–	–	50	50
Total,	773	10,335	9,851	484	773	11,108	9,882	793·00	–	–	274	173	325	95	111	59	180	50	1,267

(a) Includes 12 born in the House.
(b) „ 1 „ „
(c) Includes 344 non-parturient.
(d) „ 109 „
(e) Resigned.

No. 6.

PRICE LIST of ARTICLES supplied to the HOUSE OF INDUSTRY GOVERNMENT HOSPITALS, per Contract or otherwise, for the year ending 31st March, 1894.

Article.	Rate. £	s.	d.	Remarks.
1. Beef, per lb.	0	0	5	Shoulders, necks, tail end, without bone.
	0	0	6½	Round, without fat or bone; also Ribs.
2. Mutton, „	0	0	6½	Legs, with short laps
3. Bacon, „	0	0	8½	Best Limerick Middles.
4. Bread, „	0	0	1 5/12	Equal to 4½d. for 4 lbs.
5. Oatmeal, per stone	0	1	10	
6. Potatoes, „	0	0	5½	
7. Rice, „	0	1	5	
8. Tea, per lb.	0	1	5	
9. Sugar, „	0	0	1½	
10. Coffee, „	0	1	7	
11. Cocoa, „		—		Not in dietary
12. New Milk, per gal.	0	0	7	Pure.
13. Buttermilk, „	0	0	2	
14. Whiskey, „	0	14	6	Proof.
15. Brandy, „	1	0	0	
16. Wine, Port, „	0	7	6	
Marsala, „	0	6	6	
17. Porter, per ¼ brl.	0	7	0	
18. Butter, per lb.	0	1	1	
19. Eggs, per doz.	0	1	0	
20. Soap, Brown, per cwt.	0	15	0	Barrington's.
Crown, „	1	2	0	
White, „	0	17	0	
21. Coals, per ton.	0	17	0	Wallsend (screened and delivered.)

PRICE LIST of ARTICLES supplied to the MEATH HOSPITAL, per Contract or otherwise, for the year ending 31st March, 1894.

Article.	Rate. £	s.	d.	Remarks.
1. Beef For Beef Tea, per lb.	0	0	4¼	
Corned, „	0	0	7½	
Roasting, „	0	0	7½	
2. Mutton, „	0	0	7½	
3. Bacon, „	0	0	9	Average.
4. Bread,		—		Shop prices, 10 per cent. off.
5. Oatmeal, per stone	0	1	9	
6. Potatoes, „	0	0	6	Average.
7. Rice, „	0	2	9	
8. Tea, per lb.	0	1	8	
9. Sugar, per cwt.	0	16	4	
	0	18	8	
10. Coffee, per lb.	0	1	8	Not much used
11. Cocoa (Patent), per tin	0	0	8	
12. New Milk, per gal.	0	0	9½	
13 Buttermilk, „	0	0	2	
14. Whiskey, „	0	14	6	
15. Brandy, „	0	24	0	
16. Wine (Port), per octave.	3	15	0	
17. Porter, per ½ brl.	0	19	6	Guinness's XX.
18. Butter, per lb.	0	1	0½	Average.
19. Eggs per doz.	0	1	0	Do.
20. Soap, White, per cwt.	0	15	6	
Brown, „	0	14	6	
21. Coals, per ton	0	14	6	Wigan.

PRICE LIST of ARTICLES supplied to the ROTUNDA LYING-IN HOSPITAL per Contract or otherwise, for the Year ending 31st March, 1894.

Article.	Rate. £	s.	d.	Observations.
1. Beef, . . per lb.	0	0	6½ to 6¾	
2. Mutton, . „	0	0	6¾	
3. Bacon, . „	0	0	8	
5. Bread, . per 2-lb. loaf,	0	0	2¾	Less 10 per cent. discount.
6. Oatmeal, per cwt.	0	14	0	
7. Potatoes, . .		—		At current prices.
8. Rice, . per stone,	0	1	9	
9. Tea, . . per lb.	0	1	4	
10. Sugar, . . per stone,	0	1	10 to 2 11	
11. Coffee, . per lb.	0	1	4	
12. Cocoa, . „	0	0	3	
13. New Milk, . per gal.	0	0	8	
14. Buttermilk, . „		—		
15. Whiskey, . „	0	19	6	
16. Brandy, . . .		—		
17. Wine, {Port, per doz.	1	6	0	
17. Wine, {Sherry, „	1	2	0	
18. Porter, . . .		—		
18. Butter, . . per lb.	0	1	2	
19. Eggs, . . per doz.	0	1	0	
20. Soap, . . per cwt.	0	15	0	
21. Coals, . . per ton,	0	16	6	

PRICE LIST of ARTICLES supplied to the COOMBE LYING-IN HOSPITAL per Contract or otherwise, for the year ending 31st March, 1894.

Article.	Rate. £	s.	d.	Remarks.
1. Beef, . . per lb.	0	0	7	
2. Mutton, . . „	0	0	7	
3. Bacon, . . „	0	0	10	
4. Bread, . per 2-lb. loaf,	0	0	2½	Less 10 per cent. discount.
5. Oatmeal, . . per stone,	0	2	0	
6. Potatoes, . . „		—		Market price.
7. Rice, . . „	0	2	4	
8. Tea, . . . per lb.	0	1	4	
9. Sugar, . . „	2*d.* and 1½*d.*			
10. Coffee, . . „		—		
11. Cocoa, . . „		—		
12. New Milk, . per gal.	0	0	8	
13. Buttermilk, . „	0	0	2½	
14. Whiskey, . „	0	16	8	
15. Brandy, . . per flask	0	5	0	
16. Wine, . . per doz.	0	18	0	
17. Porter, . . .		—		
18. Butter, . . per lb.	0	1	3	
19. Eggs, . . per doz.	0	1	0	
20. Soap, . . per stone,	0	3	0	
21. Coals, . . per ton,	0	15	9	Whitehaven.

PRICE LIST of ARTICLES supplied to the ROYAL HOSPITAL for INCURABLES, per Contract or otherwise, for the Year ending 31st March, 1894.

Article.	Rate. £ s. d.	Remarks.
1 Beef, . . per lb.	0 0 6	
2. Mutton, . . ,,	0 0 7	
3. Bacon, . . per cwt.	4 3 0	
4. Bread, per 2 lbs. loaf .	0 0 2⅜	
5. Oatmeal, . . per cwt.	0 14 0	
6. Potatoes, . . per ton,	3 7 0	
7. Rice, . . per stone	0 4 0	
8. Tea, . . . per lb.	0 1 8	
9. Sugar, . . ,,	0 0 2	
10. Coffee, . . ,,	0 1 10	
11. Cocoa, . . ,,	0 0 4½	
12. New Milk, . per gal.	0 0 8	
13. Buttermilk, . ,,	—	
14. Whiskey, . ,,	0 16 0	
15. Brandy, . . ,,	1 4 0	
16. Wine, Port, . per doz.	1 4 0	
16. Wine, Sherry, ,,	0 16 0	
17. Porter, . . per gal.	0 0 10	
18. Butter, . . per lb.	0 1 0	
19. Eggs, . . per doz.	0 0 11½	
20. Soap, Crown, per cwt.	1 3 6	
20. Soap, Brown, ,,	1 0 0	
21. Coals, . . per ton	0 13 8	
22. Slack, . . ,,	0 9 0	

PRICE LIST of ARTICLES supplied to the CORK-STREET FEVER HOSPITAL, per Contract or otherwise, for the year ending 31st March, 1894.

Article.	Rate. £ s. d.	Remarks.
1. Beef, Rounds, per lb.	7d. & 7d.	
1. Beef, Ribs ,,	6d. & 7d	
1. Beef, Corned ,,	5d. & 5½d.	
2. Mutton, . . ,,	7½d. & 7¾d.	
3. Bacon, . . ,,	8½d.	
4. Bread, . per 2 lb. loaf	2 9/10d. & 1 9/10d.	Nett price.
5. Oatmeal, ...	—	No Contract.
6. Potatoes, ...	—	No Contract.
7. Rice, . . per stone,	—	No Contract.
8. Tea, . . per lb.	0 1 9	
9. Sugar, ...	—	No contract.
10. Coffee, ...	—	No contract.
11. Cocoa, ...	—	No contract.
12. New Milk, . per gal.	8d. & 8d.	
13. Buttermilk, . ,,	2d. & 2d.	
14. Whiskey, . ,,	0 17 6	
15. Brandy, ...	—	No contract.
16. Wine, . . per bot.	0 2 0	
17. Porter, . . per doz.	0 3 6	
18. Butter, ...	—	Wholesale price, per day.
19. Eggs, . . per doz.	—	Wholesale price, per day.
20. Soap, . . per cwt.	—	No contract.
21. Coals, . . per ton	0 12 8 0 16 0 0 19 0	

PRICE LIST of ARTICLES supplied to the WESTMORLAND LOCK (GOVERNMENT) HOSPITAL, per Contract or otherwise, for the year ending 31st March, 1894.

Article.	Rate. £	s.	d.	Remarks.
1. Beef, per lb.	0	0	5¾	
2. Mutton, „	0	0	6¾	
3. Bacon, „	0	0	8	
4. Bread, „	0	0	1 1/16	Equal to 4¼*d.* per 4 lb. loaf.
5. Oatmeal, per stone,	0	1	10½	
6. Potatoes, „	0	0	5	
7. Rice, per lb.	0	0	2	
8. Tea, „	0	1	6	
9. Sugar, „	0	0	2¼	
10. Coffee,		—		Not in dietary.
11. Cocoa,		—		do.
12. New Milk, per gal.	0	0	7½	
13. Buttermilk, „	0	0	2	
14. Whiskey, per gal.	0	14	0	
15. Brandy, „	1	0	0	
16. Wine, Marsala, „	0	7	0	
Port, „	0	9	0	
17. Porter, per ½ brl.	0	13	4	
18. Butter, per lb.	0	0	10	
19. Eggs, per doz.	0	1	0	
20. Soap, White, per cwt.	1	2	0	
Brown, „	0	19	6	
21. Coals, per ton,	0	15	3	Best Whitehaven.

PRICE LIST of ARTICLES supplied to the ST. MARK'S OPHTHALMIC HOSPITAL, per Contract or otherwise, for the year ending 31st March, 1894.

Article.	Rate. £	s.	d.	Remarks.
1. Beef, per lb.	0	0	7½	Includes prime joints, legs, &c.
2. Mutton, „	0	0	7½	
3. Bacon, „	0	0	9	
4. Bread, „	0	0	1½	Equal 6*d.* for 4lb. loaf, less 7½ per cent.
5. Oatmeal, per stone,	0	2	0	
6. Potatoes, „	0	0	6	
7. Rice, per lb.	0	3	6	
8. Tea, „	0	1	8	
9. Sugar, „	0	0	2	
10. Coffee, „	0	2	0	
11. Cocoa, tin.	0	1	8	Van Houten's.
12. New Milk, per gal.	0	1	0	
13. Buttermilk, „		—		Not used.
14. Whiskey, „		—		Seldom, if ever, prescribed.
15. Brandy, „		—		
16. Wine, Marsala, „		—		
Port, „		—		
17. Porter, per doz.	0	1	8	
18. Butter, per lb.	0	1	2	
19. Eggs, per doz.	0	1	0	
20. Soap, per stone.	0	3	6	
21. Coals, per ton	0	17	6	Average.

PRICE LIST of ARTICLES supplied to STEEVENS's HOSPITAL, per Contract or otherwise, for the year ending 31st March, 1894.

Article.	Rate. £ s. d.	Remarks.
1. Beef, . . per lb.	0 0 5½ / 0 0 6	
2. Mutton, . . ,,	0 0 6	
3. Bacon, . . ,,	0 0 8	
4. Bread, ...	—	1s. 4d. off current prices, less 7½ per cent discount.
5. Oatmeal, . . per cwt.	0 16 0	
6. Potatoes, . . ,,	0 4 6	
7. Rice, . . per stone,	0 1 5½	
8. Tea, . . per lb.	0 1 6	
9. Sugar, . . ,,	0 0 2	
10. Coffee, . . ,,	0 1 8	
11. Cocoa, ...	0 1 4	
12. New Milk, . per gal.	0 0 8	
13. Buttermilk, . ,,	0 0 2	
14. Whiskey, . ,,	0 14 6	
15. Brandy, . . ,,	1 0 0	
16. Wine, Port, . per doz.	1 0 0	
17. Porter, . . per gal.	0 2 5½	
18. Butter, . . per lb.	0 1 1	
19. Eggs, ...	0 9 6	Per 120.
20. Soaps, . . per cwt.	0 15 6 / 0 17 6	
21. Coals, . . per ton,	0 12 6	

Appendix No. 7. Dietaries.

TABLE No. 7.—DIETARIES.

WESTMORLAND LOCK HOSPITAL.

DIETS.	Breakfast.	Dinner.	Supper.
Low Diet.	Bread, 4 oz. Tea, ¾ pint.	Bread, 4 oz. New Milk, ¾ pint. On Friday—Bread, 4 oz.; New Milk, ¾ pint; Gruel, ¾ pint.	Bread, 4 oz. Tea, ¾ pint. Whey, ¾ pint.
Middle Diet	Bread, 6 oz. Tea, ¾ pint.	Bread, 6 oz., or Potatoes, 1 lb. Mutton Chop, broiled or fried, 8 oz. On Friday—Bread, 6 oz.; Gruel, ¾ pint, instead of Mutton.	Bread, 4 oz. Tea, ¾ pint.
Full Diet.	Bread, 8 oz. Tea, ¾ pint.	Bread, 8 oz., or Potatoes, 1 lb. Beef, boiled, 8 oz., with broth, ¾ pint. On Friday—Bread, 8 oz.; Gruel, ¾ pint, instead of Potatoes, Beef, &c.	Bread, 4 oz. Tea, ¾ pint.
Children's Diet.	N. Milk, 1 pt. Bread, 6 oz. (daily.)	Extras, if prescribed.	
Admission Diet.	Each Adult Patient to get on day of Admission, Dinner, Bread, 8 oz.; Supper, Bread, 4 oz.		

EXTRAS ALLOWED (if specially prescribed) WITH THE UNDERMENTIONED DIETS.

Low Diet.—One Egg; Beef Tea, ¾ pint, or New Milk, ¾ pint, or Arrowroot, ¾ pint, or Rice Milk, ¾ pint. Wine, or Whiskey, or Gin, as specially prescribed.

Middle Diet.—Bread, 4 oz.; 1 Egg; New Milk, ¾ pint, or Porter, ½ pint, or Gin or Wine, not exceeding (except in an urgent case) 4 oz.

Full Diet.—New Milk, ¾ pint, or Porter, ½ pint.

Children's Diet.—Bread, 4 oz.; New Milk, ¾ pint; Arrowroot or Sago, 1 oz.; Sugar with A. or S., ½ oz.; or Beef Tea, ¾ pint.

FORMULARIES.

Tea (8¾ pints).	Beef, with Broth (8¾ pints).	Beef Tea (8¾ pints).
Tea, . . . 1½ oz. Sugar, . . 4 oz. New Milk, . . ½ pt. Allowance for each Patient per diem— Tea for Bkt. 3/16 oz. } 3/8 oz. „ Supr. 3/16 oz. } Sugar Bkt. ½ oz. } 1 oz. „ Supr. ½ oz. } New Milk, . ⅛ pt.	Beef, exclusive of bone, 4 lb. Barley, . . . ½ lb. Oatmeal, . . . 1 oz. Parsley, . . . 1 oz. Thyme, . . . ½ oz. Onions or Leeks . . ½ lb. Pepper and Salt to taste.	Beef (lean without bone), 6 lbs. Pepper and Salt to taste. Allowance for each Patient— Beef to make ¾ pt. B. T., 12 oz.

Whey (8¾ pints).	Gruel (8¾ pints).	Arrowroot or Rice Milk (⅜ pint).
New Milk, 2 quarts. Butter Milk, 1 quart. Allowance for Whey each Patient— New Milk, . ½ pt. Buttermilk, . ¼ pt.	Oatmeal . . . 12 oz. Sugar . . . 4 oz. Ginger to flavour. Steep the meal from night before. Boil for two hours. Allowance for each Patient for Gruel— Oatmeal . . 1½ oz. Sugar . . . ½ z	Arrowroot or Rice, . 1 oz. Sugar, . . . ½ oz. New Milk, . . . ¾ pt.

Breakfast at Nine o'clock, A.M., Dinner at Two o'clock, P.M., Supper at Seven o'clock, P.M.

CORK-STREET HOSPITAL

LOW DIET.

Beef Tea; Milk; Rice; Tea; Bread.

Extra Beef Tea when ordered by Physicians—1 lb. Beef to 1 pint water.

FULL DIET.

8 oz. Mutton; Soups; Bread.

Extras ordered by Physicians—Eggs, Chicken, Chicken Jelly, Milk Pudding, Fish, &c., Potatoes.

RICHMOND, WHITWORTH, and HARDWICKE HOSPITALS.

DIETS.	Breakfast.	Dinner.	Supper.
No. 1, Richmond and Whitworth,	Bread, 4 oz. Tea, ¾ pint.	Bread, 4 oz. New Milk, 1½ pints.	Bread, 4 oz. Tea, ¾ pint. Whey, 1 pint.
No. 1, Hardwicke,	Tea, ¾ pint.	New Milk, ¾ pint.	Tea, ¾ pint. Whey, 1 pint.
No. 2. . . .	Bread, 4 oz. Tea, ¾ pint.	Bread, 4 oz. Beef, boiled (exclusive of bone), ½ lb., with broth, ⅜ pint; or stewed with vegetables.	Bread, 4 oz. Tea, ¾ pint.
No. 3, . .	Bread, 4 oz. Tea, ¾ pint.	Bread, 4 oz. Mutton, roast or boiled (exclusive of bone), ½lb. and vegetables,	Bread, 4 oz. Tea, ¾ pint.
For Richmond and Whitworth only	—	Potatoes, 1lb.	
No. 4, . .	Bread, 6 oz. Tea, ¾ pint.	Bread, 6 oz., or potatoes, 1 lb. Beef, boiled (exclusive of bone), ½ lb., with broth, ¾ pint; or stewed with vegetables. Fish, ½ lb., may be substituted for dinner meat with diets Nos. 2, 3, 4, at discretion of medical attendant.	Bread, 4 oz. Tea, ¾ pint.

Appendix.
No. 7.
Dietaries.

EXTRAS ALLOWED WITH UNDERMENTIONED DIETS.

No. 1.—1 Egg; Bread, 4 oz. (Hardwicke only); Arrowroot, ¾ pint, or Beef Tea, ¾ pint, or New Milk, ¾ pint, or Rice Milk, ¾ pint; Wine, or Brandy, or Gin, or Whiskey, as specially ordered; or Porter, ½ pint.

No. 2.—1 Egg, New Milk, ¾ pint, or Porter, ½ pint, or Gin or Wine, not exceeding 4 oz.

No. 3.—New Milk, ¾ pint, or Porter, ½ pint, or Wine, not exceeding 4 oz. Fresh Vegetables as ordered.

No. 4.—1 Egg; New Milk, ¾ pint, or Porter, ½ pint.

Breakfast at Half-past Eight o'clock. Dinner at Half-past One o'clock. Supper at Seven o'clock.

DOCTOR STEEVENS'S HOSPITAL.

SCALE OF DIETS USED.

FULL DIETS—BREAKFAST.

1 pint Tea, 6 oz. Bread, ¾ oz. Butter.

DINNER.

Sunday, Tuesday, Thursday,	Roast or Boiled Mutton, 6 oz.; Vegetables, 1 lb. Potatoes.
Monday, Wednesday, Saturday,	1 pint Soup, 6 oz. Stewed Beef, 1 lb. Potatoes.
Friday,	10 oz. Fish, and 1 lb. Potatoes.
Lunch,	1 pint Milk, and 2 oz. Bread.
Tea,	1 pint Tea, ¾ oz. Butter, 4 oz. Bread.
Supper,	1 pint Milk.

EXTRA DIETS.

Beef Tea, Chops, Chickens, Milk, Eggs, Fish, Jellies, Puddings, Cocoa, Coffee, Porridge, and Stimulants as ordered by Physicians and Surgeons.

MEATH HOSPITAL.

PATIENTS' DIETARY.

The Patients' Dietary has been revised, and the following recommended on the 13th February, 1893, to be tried for three months, and if approved, then to be permanently adopted:—

FULL DIET—BREAKFAST.

Tea, with Sugar and Milk, 1 pint, Bread, with Butter, 6 oz.

DINNER.

Sunday,	Roast Legs of Mutton, 6 oz., with Vegetables and Potatoes.
Monday,	Stewed Beef, 6 oz., Soup, 1 pint, and Potatoes.
Tuesday,	Roast Legs of Mutton, 6 oz., Vegetables and Potatoes.
Wednesday,	Stewed Beef, 6 oz., Soup, 1 pint, and Potatoes.
Thursday,	Roast Legs of Mutton, 6 oz., Vegetables and Potatoes.
Friday,	White Fish, 12 oz., Potatoes, or Bread.
Saturday,	Stewed Beef, 6 oz., Soup, 1 pint, and Potatoes.
Tea,	Tea, with Sugar and Milk, 1 pint, Bread, with Butter, 6 oz., or Oatmeal Porridge, 16 oz., and New Milk, 1 pint.
Supper,	Whey or Milk, 1 pint.

FEVER DIET.

Per Diem,	Milk, Barley-Water, Beef Tea, &c., as ordered by Physician.

SPECIAL DIET.

Breakfast,	Same as Full Diet.
Dinner,	As ordered by Physician or Surgeon.
Tea,	Same as Full Diet.
Supper,	Ditto.

The Medical Attendant can order, when necessary, Beef Tea, Milk, Eggs, Chop, Fowl, Fish, Rice, Puddings, Fruit, Cocoa, Ice, Mineral Waters, Stimulants, &c.; but they will be given only when signed for by him.

Coombe Hospital.

No Extras allowed unless ordered each day and initialled by one of the Medical Officers.

Diets.	Breakfast.	Dinner and Luncheon.	Supper.
No. 1, . . .	Bread, 4 oz. Tea, 1 pint.	Bread, 4 oz. Gruel, 1 pint. Gruel, 1 pint, Milk, ½ pint, } Luncheon.	Bread, 4 oz. Tea, 1 pint. Milk, 1 pint, and 1 pint Whey.
No. 2, . . .	Bread, 4 oz. Tea, 1 pint.	Bread, 4 oz. Beef, boiled (exclusive of bone), ½ lb., with Broth, ⅜ pint, or stewed with vegetables.	Bread, 4 oz. Tea, 1 pint. Whey, 1 pint.
No. 3, . . .	Bread, 4 oz. Tea, 1 pint.	Bread, 4 oz. Mutton, broiled (exclusive of bone), ½ lb.	Bread, 4 oz. Tea, 1 pint.
No. 4, . . .	Bread, 4 oz. Tea, 1 pint.	Bread, 6 oz., or Potatoes 1 lb. Beef, boiled (exclusive of bone), ½ lb., with Broth, 1 pint, or stewed with vegetables.	Bread, 4 oz. Tea, 1 pint.

Extras allowed with undermentioned Diet.

No. 1.—Bread, 4 oz.; Arrowroot, 1 pint; Beef Tea, 1 pint; New Milk, ½ pint; Rice Milk, 1 pint; Wine, or Brandy, or Whiskey, as specially ordered; or Porter, 1 pint.

No. 2.—One Egg; New Milk, ½ pint; Porter, 1 small bottle; or Gin or Wine, not exceeding 4 oz.

No. 3.—New Milk, ¾ pint; Porter, one small bottle; or Wine, as ordered. Fresh Vegetables as ordered.

No. 4.—New Milk, ¾ pint; Porter, 1 small bottle.

Beef to be given boiled on Sundays, Mondays, and Saturdays, and stewed on Tuesdays and Thursdays.

Potatoes, 1 lb., on Mondays, Thursdays, and Saturdays, to be substituted for Dinner Bread in Diet No. 4.

Rice Milk, 1 pint, on Wednesdays; Gruel, 1 pint, on Fridays, to be substituted for Meat in Diets Nos. 2, 3, and 4.

Formularies.

Tea (7½ pints).	Boiled Beef with Broth (18 pints).	Beef Tea (6 pints).
Tea, . . 2 oz. Sugar, . . 6 oz. New Milk, ½ pint	Beef (exclusive of bone), . 9 lb. Onions or Leeks, . . ½ lb. Pepper and Salt to taste.	Beef (lean, without bone), 4 lb. Pepper and Salt to taste.
		Whey.
		New Milk, . . . 1 quart. Buttermilk, . . . 1 pint.

Gruel (6 pints).	Arrowroot (¾ pint).	Warm Milk.	Rice Milk (6 pints)
Oatmeal, . 8 oz. Sugar, . 2 oz. Steep the meal from night before, boil for two hours.	New Milk, . 1 pint. Arrowroot, ½ oz. Sugar, . ½ oz.	New Milk, . 3 pints. Boiling Water, 1 pint.	Rice, . . 6 oz. Sugar, . 2 oz. New Milk, 6 pints.

Breakfast at Half-past Eight o'clock, Dinner at Half-past One o'clock, Supper at Six o'clock.

Dietary for Nurses and Servants.

Tea, ...	¼ lb. per week.
Sugar, . . .	1 lb. ,,
Bread, . . .	3 loaves (2 lb. loaves).
Butter, . . .	¾ lb.
Potatoes, . . .	1 lb. daily.
Vegetables, . . .	3 times per week.
Meat, . . .	¾ lb. of meat or bacon daily, without bone.
Milk, . . .	1 pint each daily.
Eggs, . . .	2 on Friday for dinner.
Butter, . . .	2 oz. ,,

Appendix.

No. 7.

Dietaries

St. Mark's Ophthalmic and Aural Hospital.

Diets.	Breakfast.	Dinner.	Supper.
1. Low Diet, . .	Bread, 4 oz. Tea, 1 pint.	Bread, 4 oz.; new milk, 1 pint. On Friday—Gruel, 1 pint, may be given as a substitute for Dinner Milk.	Bread, 4 oz.; Tea or Cocoa, 1 pint; Whey 1 pint.
2. Ordinary Diet, . Monday, Tuesday, Wednesday, and Saturday.	Bread, 8 oz Tea, 1 pint.	Bread, 8 oz.; Soup, 1 pint. On Friday—Bread, 8 oz; Gruel, 1 pint; or Boiled Rice with Sugar and Milk.	Bread, 4 oz.; Tea or Cocoa, 1 Pint.
3. Ordinary Diet, . Sunday and Thursday.	Bread, 8 oz. Tea, 1 pint.	Bread, 8 oz.; or Potatoes, 1 lb.; Beef, Boiled, 8 oz.; or Mutton Chop, Fried; Fresh Vegetables On Friday—Bread 8 oz.; Gruel, 1 pint; or Boiled Rice with Sugar and Milk.	Bread, 4 oz.; Tea or Cocoa, 1 pint.

Extras allowed (if specially prescribed) with the undermentioned Diets.

1. *Low Diet.*—1 Egg; Beef Tea, 1 pint; or New Milk, 1 pint; or Arrowroot, 1 pint; or Rice Milk, 1 pint; Wine, or Whiskey, or Gin at discretion of Medical Attendant, or Porter; 1 pint.
2. *Ordinary Diet.*—1 Egg; New Milk, 1 pint; Wine, or Whiskey, or Gin at discretion of Medical Attendant; or Porter, 1 pint.
3. *Ordinary Diet.*—1 Egg; New Milk, 1 pint; Wine, or Whiskey, or Gin at discretion of Medical Attendant; or Porter, 1 pint.

The Surgeons may, by a written order in Diet Book prescribe in special cases, on Fridays, a Mutton Chop in lieu of Dinner Gruel, and Oatmeal Stirabout and New Milk for Breakfast on any day in lieu of Bread and Tea.

Formularies.

Tea (8 pints.)

Tea,	2 oz.
Sugar,	6 oz.
New Milk,	1 pint.

Cocoa (8 pints).

Soluble Cocoa,	4 oz.
Sugar,	6 oz.
New Milk,	1 pint.

Beef with Broth (32 pints).

Ox Head,	1
Beef, exclusive of bone, 2 oz. to each Patient.	4 lb.
Barley,	1 lb.
or	
Split Peas,	½ lb.
Oatmeal,	2 lb.
Parsley, Thyme, Onions, Leeks or Celery,	to flavour

Pepper and Salt to taste.

The No. 2 Ordinary Diet Beef to be cut small previous to boiling, and served in the Soup.

The No. 3 Ordinary Diet Beef to be served whole.

Beef Tea (8 pints).

Beef, lean, without bone, 6 lb.

Pepper and Salt to taste.

The Beef to be cut small, and placed in cold water for three hours previous to simmering.

Whey (8 pints).

New Milk,	5 pints.
Butter Milk,	3 pint.

Gruel (8 pints).

Oatmeal,	12 oz.
Sugar,	6 oz.

Ginger to flavour.

Steep the meal from night before, boil for two hours.

Stirabout (1 quart).

Oatmeal,	4 oz.
New Milk to be issued with each quart of stirabout.	1 pint

Arrowroot or Rice Milk (1 pint).

Arrowroot or Rice,	1 oz.
Sugar,	½ oz.
New Milk,	1 pint.

Dinner Rice.

Boiled Rice, (weight uncooked)	4 oz.
Sugar,	1 oz.
New Milk,	½ pint.

Breakfast at Half-past Seven o'clock, A.M., Dinner at Two o'clock, P.M., Supper at Six o'clock, P.M.

ROTUNDA AUXILIARY HOSPITAL.

DIET.	Breakfast.	Dinner.	Supper.
Full Diet, .	Bread, 4 oz.; Tea, 1 pint; Butter, ½ oz.; or, Bread, 4 oz.; Stirabout, 1 pint; Milk, 1 pint.	4 oz. Cooked Meat, Beef or Mutton, roasted or boiled, alternately; ½ lb. Potatoes; ½ pint Broth; or, ¾ pint Broth, with Meat, Rice Pudding, and Bread, 4 oz.; or, 8 oz. White Fish instead of Broth.	Bread, 6 oz.; Tea, 1 pint; or, Bread, 4 oz., and 1 pint of Gruel; or, 1 pint Stirabout and ½ pint Milk.
Low Diet, .	Bread, 4 oz.; Milk, Tea, or Gruel, 1 pint; Butter, ½ oz.	Bread, 4 oz.; Milk or Beef Tea, 1 pint.	Same as Breakfast.
Fever Diet, .	Milk, Whey, Beef Tea, Chicken Broth, Stimulants, Bread, Arrowroot, Sago, or Corn Flour, as ordered.		

MATERNITY HOSPITAL.

Low Diet.—2 pints hot Milk, 1 pint Gruel, 1 pint Broth. Tea, Bread, a sufficiency, Beef Tea, Eggs, or other extras when ordered.

Full Diet.—6 oz. meat in place of Broth.

AUXILIARY HOSPITAL.

Fever Diet.—Milk, Beef Tea, &c., as ordered.

Low Diet.—Milk, 2 pints, Beef Tea, 1 pint, Butter, 1 oz., Sugar, 1 oz. Tea and Bread a sufficiency.

Full Diet—Milk, 1 pint, Broth, 1 pint, Meat, 6 oz. (uncooked), with Potatoes, or Fish and Pudding. Tea and Bread, a sufficiency. Extras as ordered.

For Beef Tea we allow ¾ lb. beef to 1 pint water. For Broth—Stock with barley, oatmeal, Herbs, &c. For Gruel—To 7 pints Milk, 1 lb. Oatmeal, 4 oz. Sugar, and a little Ginger. Tea, 1 oz for 6 patients.

Each patient on admission shall be placed on Low Diet, until the proper Diet is ordered, or by the Physicians. No extra shall be given, unless on the order of the Master or Assistants, nor re-issued unless the order therefor is initialed on the Diet Sheet by the Physician at his regular visit.

ROYAL HOSPITAL FOR INCURABLES, DONNYBROOK.

DIETARY (FULL).

Monday,* . .	⅔ lb. Potatoes, 3½ oz. Tea, ¾ lb. Sugar, 6 oz. Bacon, Cabbage, 1 lb. Bread, ½ pint Milk.
Tuesday, . .	⅔ lb. Potatoes, 3 oz. Butter, 8 oz. Mutton, 1 lb. Bread, ½ pint Milk.
Wednesday, .	⅔ lb. Potatoes, ½ lb. Beef, 1 lb. Bread, ½ pint Milk.
Thursday, .	⅔ lb. Potatoes, 6 oz. Bacon, Cabbage, 1 lb. Bread, ½ pint Milk.
Friday, . .	⅔ lb. Potatoes, Fish, 3 oz. Butter, 1 lb. Bread, ½ pint Milk.
Saturday, . .	⅔ lb. Potatoes, ½ lb. Beef, 1 lb. Bread, ½ pint Milk, 1 pint Soup.
Sunday, . .	⅔ lb. Potatoes, 8 oz. Mutton, 1 lb. Bread, ½ pint Milk.

DIETARY (INVALID).

Monday,* . .	⅔ lb. Potatoes, 3½ oz. Tea, ¾ lb. Sugar, 6 oz. Mutton, Cabbage, ½ lb. Bread, ½ pint Milk.
Tuesday, . .	⅓ lb. Potatoes, 2 Eggs for Dinner, 3 oz. Butter, ½ lb. Bread, ½ pint Milk.
Wednesday, .	⅔ lb. Potatoes, 6 oz. Mutton, ½ lb. Bread, ½ pint Milk.
Thursday, . .	⅔ lb. Potatoes, 6 oz. Bacon, Cabbage, ½ lb. Bread, ½ pint Milk.
Friday, . .	⅔ lb. Potatoes, Fish, 3 oz. Butter, ½ lb. Bread, ½ pint Milk.
Saturday, . .	⅔ lb. Potatoes, 2 Eggs for Dinner, ½ lb. Bread, ½ pint Milk.
Sunday, . .	⅔ lb. Potatoes, 6 oz. Mutton, ½ lb. Bread, ½ pint Milk.

* Week's Tea and Sugar.

No. 8.

Westmorland Lock (Government) Hospital.

Board of Governors.

Appointed by His Excellency the Lord Lieutenant.

(19 & 20 Vic., cap. 110.)

Date of Appointment.	Members' Names.
1870, May 21st,	Edward Fottrell, esq., J.P.
1877, January 5th,	Sir George B. Owens, Knt., M.D., J.P.
1879, February 8th,	Sir Philip Crampton Smyly, esq., M.D., F.R.C.S.I.
1880, January 31st,	John Robert Mallins, esq.
1880, November 30th,	Francis Richard Cruise, esq., M.D., F.R.C.P.I.
1883, December 5th,	Sir George Hornidge Porter, Bart., M.D., F.R.C.S.I., J.P., D.L.
1884, May 20th,	William Findlater, esq., D.L., J.P.
1885, June 12th,	Richard O'Shaughnessy, esq., B.L.
1888, February 21st,	John E. Barry, esq.
1888, February 21st,	Alderman Sir Robert Sexton, Knight, J.P., D.L.
1889, March 16th,	Charles Kennedy, esq., J.P.
1890, March 7th,	Lambert Hepenstal Ormsby, esq., M.D., F.R.C.S.I., J.P.
1890, June 23rd,	George Plunkett O'Farrell, esq., M.D., M.R.C.S., Eng., J.P.
1890, December 31st,	Stewart Woodhouse, esq , M.D., F.R.C.S.I.
1892, July 1st,	W. P. O'Brien, esq., C.B
1892, July 11th,	J. O. Masterson, esq,
1892, July 11th,	Wm. Watson, esq., J.P.
1892, July 11th,	Col. A. Vesey Davoren, J.P.
1893, January 25th,	Charles E. Lambkin, esq.
	George Hugh Kidd, esq., M.D.

James Wilson Hughes,
Registrar.

12*th April*, 1894.

Westmorland Lock Government Hospital.

Return showing the Attendance of each Member of the Board of Governors at the several Meetings held during the Year ended 31st March, 1894.

Number of Board Meetings held.	Number of Committee Meetings held.	Date of Meeting, 1892–93.	1. Edward Fottrell, J.P.	2. John T. Hamerton, A.M.	3. Sir G. Owens, M.D., J.P.	4. Sir Philip C. Smyly, M.D.	5. John R. Mallins.	6. Fras. R. Cruise, M.D.	7. Sir Geo. H. Porter, M.D	8. William Findlater, D.L.	9. Richard O'Shaughnessy, B.L.	10. John E. Barry.	11. Sir Robt. Sexton, D.L.	12. Charles Kennedy, J.P.	13. Lambert H. Ormsby, M.D., J.P.	14. Geo. Plunkett O'Farrell, M.D., J.P.	15. Stewart Woodhouse, M.D.	16. W. P. O'Brien, C.B.	17. John O. Mesterson.	18. William Watson, J.P.	19. Colonel A. Vesey Davoren, D.L.	20. Charles E. Lambpkin.	21. Geo. H. Kidd, M.D.	Total Governors present at Board Meetings.	Observations.
		1893.																							
1	–	April, . . 1,	1		–	–	–				1	–	1	–	1	–	1	–	1	–	1	1		8	
2	–	May, . . 6,	1		1	1	1	1	1	1	1	1	1	–	1	1	1	1	1	–	1	1		17	
3	–	,, . . 20,	1		1	–	1	1	1	1	1	1	–	1	1	–	–	–	1	–	1	1		13	Special.
4	–	June, . . 3,	1		1	–	1	1	1	1	1	1	1	1	1	1	1	–	1	–	1	1		16	
5	–	July, . . 1,	1		1	–	–	–	–	–	–	1	–	–	1	1	–	–	1	–	–	1		7	
6	–	August, . . 5,	1		1	–	–	–	–	1	–	–	1	1	1	–	1	1	1	–	–	1		10	
7	–	September, . . 2,	1		1	–	1	–	–	–	–	1	1	–	1	–	1	–	1	–	1	–		9	
8	–	October, . 7,	1		1	–	1	–	–	–	1	1	–	1	–	–	–	–	1	–	–	1		8	
9	–	November, . . 4,	–		1	–	–	–	–	1	–	1	1	–	1	–	1	–	–	–	–	–		7	
10	–	December, . 2,	1		1	–	–	–	–	1	–	–	1	1	1	1	–	1	–	–	–	1		10	
		1894.																							
11	–	January, . . 6,	–		–	–	–	–	–	–	1	–	1	1	1	–	–	–	1	–	–	1		6	
12	–	,, . . 16,	–		1	–	–	–	1	–	1	–	–	1	1	–	–	1	–	–	1	–		7	Special, on occasion of opening New Chapel for Protestant Inmates.
13	–	February, . . 3,	–		1	–	–	–	–	–	1	1	1	1	1	–	1	1	1	–	–	1		11	
14	–	March, . 3,	1		1	–	–	–	1	–	1	1	1	1	1	1	1	–	1	–	–	1		12	
		Total, .	10	Deceased, August, 1893.	12	1	5	3	5	6	9	9	10	9	13	5	8	5	11	–	6	11	Appointed 18th September, 1893.	141	

Westmorland Lock Government Hospital,
May, 1894.

(Certified), J. W. Hughes, *Registrar.*

House of Industry (Government) Hospitals.

Board of Governors.

Appointed by His Excellency the Lord Lieutenant.
(19 & 20 *Vic.*, *Cap.* 110.)

1. The Right Hon. the Earl of Meath, Chairman.
2. Charles E. Martin, esq., J.P.
3. Sir William Stokes, M.D., F.R.C.S.I.
4. John R. Mallins, esq.
5. Sir John Banks, K.C.B., M.D.
6. Sir Percy R. Grace, Bart., J.P., D.L.
7. Patrick Martin, esq., Q.C.
8. Samuel Gordon, esq., M.D.
9. William Thomson, esq., M.D., F.R.C.S.I.
10. Right Hon. Joseph M. Meade, P.C.
11. Right Hon. Thomas A. Dickson, P.C.
12. James Murphy, esq.

James Wilson Hughes, *Secretary.*

Return showing the Attendance of each Member of the Board of Governors at the several Meetings held during the Year ended 31st March, 1894.

Number	Date of Meeting, 1893–94.	1. Right Hon. Earl of Meath.	2. Charles E. Martin, esq., J.P.	3. Sir William Stokes, F.R.C.S.I.	4. John R. Mallins, esq.	5. Sir John Banks, K.C.B.	6. Sir Percy R. Grace, Bart.,	7. Patrick Martin, esq., Q.C.	8. Samuel Gordon, esq., M.D.	9. William Thomson, esq., M.D.	10. Right Hon. Joseph M. Meade, P.C.	11. Right Hon. Thos. A. Dickson, P.C.	12. James Murphy, esq.	Total Governors present.
	1893.													
1	April, . . . 6,	–	–	–	–	–	1	1	–	–	–	–	1	3
2	„ . . . 13,	–	–	–	–	1	–	1	–	–	–	–	–	2
3	„ . . . 27,	–	–	–	–	–	–	1	–	–	1	1	–	3
4	May, . . . *4,	–	–	–	–	–	–	–	–	1	–	–	–	1
5	„ . . . 11,	–	–	–	–	1	1	–	–	1	1	1	–	5
6	„ . . . 18,	–	1	1	–	–	1	1	–	1	1	1	1	7
7	June, . . . 1,	–	–	–	–	1	–	–	1	1	1	1	–	4
8	„ . . . 8,	–	–	–	–	1	1	1	1	1	1	1	1	7
9	„ . . . *†15,	–	–	–	–	–	–	–	1	1	–	–	–	2
10	„ . . . 22,	–	–	1	–	–	–	–	1	–	–	–	–	2
11	„ . . . *29,	–	–	–	–	–	–	–	1	1	–	–	–	2
12	July, . . . 6,	–	–	–	–	1	–	1	1	1	1	–	–	5
13	„ . . . 20,	–	–	–	–	1	1	–	1	–	–	–	–	3
14	„ . . . *27,	–	–	–	–	–	–	1	1	–	–	–	–	2
15	August, . . 3,	–	–	–	–	–	–	–	1	1	–	–	1	3
16	„ . . . 10,	–	1	1	–	1	1	–	1	1	1	–	1	8
17	„ . . . 17,	–	–	–	–	–	1	–	1	–	–	–	–	2
18	„ . . . 24,	–	–	–	–	1	–	–	1	–	–	–	–	2
19	„ . . . 31,	–	–	–	–	–	–	–	1	–	–	–	–	1
20	September, . 7,	–	–	–	–	–	–	–	1	1	1	–	–	2
21	„ . . . 14,	–	–	–	–	–	1	1	1	1	–	–	1	5
22	„ . . . 21,	–	–	–	–	1	–	–	1	1	–	–	1	4

Those marked thus (*) are Committee Meetings. † No quorum.

RETURN showing the Attendance of each Member of the Board of Governors at the several Meetings held during the Year ended 31st March, 1894—*continued.*

Number.	Date of Meetings, 1893-94.	1. Right Hon. Earl of Meath.	1. Charles E. Martin, esq. J.P.	2. Sir William Stokes F.R.C.S.I.	3. John R. Mallins esq.	4. Sir John Banks, K.C.B.	5. Sir Percy R. Grace, Bart., D.L.	6. Patrick Martin, esq., Q.C.	7. Samuel Gordon, esq., M.D.	8. William Thomson, esq., M.D., F.R.C.S.I.	9. Right Hon. Joseph Meade, P.C.	11 Right Hon Thos. A. Dickson, P.C.	10. James Murphy, esq.	Total Governors present.
	1892.													
23	October, 5,	–	–	1	–	–	–	–	1	1	–	–	–	3
24	„ 19,	–	1	1	–	–	–	–	–	–	–	–	–	3
25	„ 26,	–	–	–	–	1	1	1	1	–	–	–	–	3
26	„ *28,	–	–	–	–	1	–	–	1	–	–	–	–	2
27	November, 2,	–	–	–	–	1	–	1	1	1	–	–	1	5
28	„ 9,	–	1	–	–	–	–	–	1	–	–	–	1	3
29	„ 16,	–	–	–	–	–	–	–	1	1	–	–	1	3
30	„ 23,	–	1	1	–	1	–	1	1	–	1	–	–	6
31	„ 30,	–	–	–	–	1	–	1	1	–	–	1	–	4
32	December, 7,	–	1	1	–	1	1	1	1	1	1	1	–	9
33	„ 14,	–	–	1	–	–	–	1	1	1	1	1	1	7
34	„ 21,	–	–	–	–	1	–	1	1	1	–	–	1	5
35	„ 28,	–	–	1	–	–	–	1	1	1	–	–	1	5
36	„ *29,	–	–	1	–	1	–	–	1	1	–	–	–	4
	1894.													
36	January, 4,	–	–	–	–	1	–	–	1	–	–	–	–	2
37	„ 11,	–	–	–	–	–	–	1	1	–	–	–	1	3
38	„ 18,	–	1	–	–	1	–	1	1	1	–	–	1	6
39	„ 25,	–	–	–	–	–	–	1	1	1	1	–	–	4
40	February, 1,	–	1	–	–	–	–	1	1	1	1	–	–	5
41	„ †6,	–	–	–	–	–	–	–	–	1	1	–	1	3
42	„ 8,	–	–	1	–	1	1	1	1	1	1		1	8
43	„ †16,	–	–	–	–	–	–	1	–	–	–	–	1	2
44	„ 22,	–	–	1	–	–	–	–	1	1	–	–	1	4
45	March, 1,	–	–	–	–	1	–	–	1	1	–	–	–	3
46	„ 8,	–	–	–	–	–	–	–	1	1	–	–	–	2
47	„ 15,	–	–	–	–	1	1	–	1	1	–	–	–	4
48	„ 22,	–	–	–	–	1	–	–	1	1	–	–	1	4
49	„ 29,	–	1	–	–	–	–	–	1	1	–	–	1	4
	Total individual attendances,	–	9	12	–	23	12	22	41	32	11	19	191	191
	Average number present at meetings,	–	–	–	–	–	–	–	–	–	–	–	–	2·17

* Special Board Meeting. † Committee Meeting.

Certified, JAMES WILSON HUGHES,
Res. Sec. and Supt.

D

RETURN of ATTENDANCES of COMMITTEE of DR. STEEVENS'S HOSPITAL for Year ended March 31st, 1894.

No.	Name.	No. of Attendances.	No.	Name.	No. of Attendances.
1	Sir Percy Grace, Bart.	1	7	The Dean of St. Patrick's,	13
2	Sir Ralph Cusack, D.L.	2	8	T. W. Grimshaw, esq.	10
3	C. Ferguson, esq., J.P.	1	9	W. Millar, esq.,	11
4	F. B. Ormsby, esq.	24			
5	E. Hamilton, esq., M.D.	20		Total,	106
6	H. C. Tweedy, esq., M.D.	24			

LIST of NAMES of the STANDING COMMITTEE of the MEATH HOSPITAL for the Year ended 31st March, 1894, and the Number of Attendances of each Member at the Board Meetings, for that period.

No.	Names.	No. of Attendances.	No.	Names.	No. of Attendances.
1	The Viscount Powerscourt, K.P.	–	15	L. Hepenstal Ormsby, esq., F.R.C.S., J.P.	22
2	Arthur Andrews, esq.	18	16	Sir George B. Owens, M.D., J.P.	18
3	George F. Brooke, esq., D.L.	–	17	George Perry, esq., J.P.	8
4	Vere Ward Brown, esq.	23	18	Sir George Porter, Bart., LL.D., D.L., Surgeon to the Queen,	4
5	John V. Cassidy, esq., J.P.	13	19	William Henry Porter, esq., M.A.	7
6	Richard J. Corballis, esq., J.P.	10	20	His Honor Judge Purcell (the late),	–
7	Colonel G. R. Dease, J.P.	1	21	Sir Philip C. Smyly, F.R.C.S.	13
8	William J. Doherty, esq., C.E., T.C., High Sheriff,	–			
9	Sir Percy R. Grace, Bart., D.L.	12			
10	Sir Howard Grubb, F.R.S.,	4			
11	Saml. E. Hamilton, esq., J.P.	18		Number of meetings, 23	211
12	John Hatchell, esq., D.L., J.P.	10			
13	William M'Comas, esq. J.P.	15		Average number at each meeting,	9·17
14	John William Moore, esq., M.D.	15			

MANAGING COMMITTEE of CORK-STREET FEVER HOSPITAL, and Number of Attendances.

No.	Names.	No. of Attendances.	No.	Names.	No. of Attendances.
1	William Jameson, J. P.,	1	11	Alderman Kernan,	–
2	Abraham Shackleton,	36	12	J. D. Fisher	39
3	Thomas P. Hogg,	–			
4	E. J. Figgis,	–			
5	John D. Wardell,	–			
6	Nicholas Lynch,	38		Total,	–
7	George Drury,	24			
8	William Perrin,	7		No. of Meetings,	52
9	J. J. Digges La Touche,	36			
10	Marcus Goodbody, J.P.	21		No Quorum,	5

List of Governors and Statement of Attendances at the Lying-in Hospital, Dublin, for the Year ended 31st March, 1894.

GOVERNORS AND GUARDIANS.

President:

* His Excellency the Lord Lieutenant.

Name.	No. of Attendances. Board.	Com.	Name.	No. of Attendances: Board.	Com.
Vice-Presidents:			Robert O'Brien Furlong, Esq.,	6	–
*The Right Hon. the Lord Chancellor,	–	–	Richard Owen Armstrong, Esq., J.P.,	–	–
*His Grace the Lord Archbishop of Dublin,	3	–	Charles G. Stanuell, Esq.,	1	–
*His Grace the Duke of Leinster,	–	–	Anthony Traill, Esq., LL.D., M.D., J.P., F.T.C.D.,	1	–
The Lord Ardilaun,	–	–	Lombe Atthill, Esq., M.D.,	3	1
Sir Ralph S. Cusack, J.P., D.L.,	–	–	Samuel F. Adair, Esq., J.P.,	9	16
The Right Hon. the Vice-Chancellor,	1	–	John Jameson, Esq., J.P.,	–	–
			Richard G. Pilkington, Esq.,	12	2
			Jonathan Hogg, Esq.,	5	–
			James Little, Esq., M.D.,	1	–
			Francis T. Dames Longworth, Esq., H.M.L.,	–	–
*His Grace The Lord Primate,	–	–	William Geale Wybrants, Esq., J.P.,	4	–
*The Right Hon. The Lord Mayor,	3	–	Thomas Greene, Esq., M.A.,	3	–
*The Commander of the Forces.	–	–	Sir Percy Raymond Grace, Bart., J.P., D.L.,	6	1
*The Very Rev. The Dean of St. Patrick's,	2	–	Robert S. Reeves, Esq.,	11	13
*The Ven. The Archdeacon of Dublin,	1	–	Robert S. Chatterton, Esq.,	1	–
*The High Sheriff of Dublin,	1	–	William Watson, Esq., J.P.,	1	–
The Recorder of Dublin,	1	–	Joseph Wilson, Esq., J.P., D.L.,	2	–
William Foot, Esq., J.P.	1	–	Marcus Tertius Moses, Esq.,	7	–
Thomas J. White, Esq.,	–	–	George Vaughan Hart, Esq., LL.B.,	1	–
James A. Hamilton, Esq., J.P.,	–	–	William Findlater, Esq., J.P.,		
John Richardson, Esq., Q.C., J.P.,	–	–	D.L.,	4	–
Chaworth J. Ferguson, Esq., J.P.,	1	–	Aquila McMahon, Esq.,	8	–
Edward Geale, Esq.	2	–	George Black Thompson, Esq.,	2	–
Robert W. Shekleton, Esq., Q.C., J.P.,	5	–	James Murphy, Esq.,	2	9
John Maunsell, Esq., J.P.,	1	–	Henry Dudgeon, Esq.,	2	13
S. Holt Close, Esq.,	–	–	W. J. Smyly, Esq., M.D., Master,	7	18
Henry Watson, Esq, J.P.,	–	–	Thomas P. Cairnes, Esq., J.P.,	5	6
Chas. Uniacke Townshend, Esq., J.P.,	1	–	Charles E. Martin, Esq., J.P.,	1	1
Francis L. Tottenham, Esq., J.P.,	–	–	John R. Orpen, Esq.,	7	2
Robert Warren, Esq., J.P., D.L.,	–	–	John Murphy, Esq.,	–	–
F. Blackburne Martley, Esq., J.P.,	–	–	W. J. Goulding, Esq., D.L.,	3	–
			Wellington Darley, Esq.,	–	–
			Alex. Knox M'Entire, Esq.,	1	–

* *Ex-officio* Governors.

Master of the Hospital.—W. J. Smyly, M.D, elected November 1st, 1889.
Consulting Physician.—James Little, M.D., F.K.Q.C.P.
Consulting Surgeon.—William Colles, M.D., F.R.C.S.I.
Assistant Physicians.—William Sidney Bagot, B.A., M.B., Univ. Dub.; L.M., Rotunda Hospital; Robert Alexander Flynn, L.R.C.S.I., L.K.Q.C.P.I., L.M.K.Q.C.P.I., L.M., Rotunda Hospital.
Treasurer.—The Bank of Ireland.
Secretary and Registrar.—Joseph Mullen, Esq., 21, North Frederick-street.
Chaplain.—Rev. Marshall Clarke Vincent, M.A., 8, St. James's-terrace, Clonskeagh.
Matron.—Mrs. Eliza Courtney.
Collector.—Mr. J. A. Malley, 85, Moyne-road, Rathmines.
Keeper of the Rotunda Rooms.—Mr. George Smyth, Rotunda Rooms, Cavendish-row.

Return of Names of the Guardians and Directors of the Coombe Lying-in Hospital,

With the Dates of Meetings, Attendances, &c., during the Year ended 31st March, 1894.

The Members of the House Committee, with the Dates of their Meetings, are marked thus (*)

List of Guardians and Directors.	1893.																				1894.									Total Board Meetings.	Total House Committee Meetings.	Grand Total.
	*April 13.	April 27.	*May 11.	May 25.	*June 8.	June 29.	*July 13.	Aug. 10.	Aug. 24.	*Sept. 14.	Sept. 21.	Sept. 28.	*Oct. 12.	Oct. 26.	*Nov. 3.	Nov. 9.	Nov. 24.	Nov. 30.	Dec 14.	Dec. 21.	*Jan 11.	Jan. 18.	Jan. 25.	*Feb. 8.	Feb. 19.	Feb. 22.	*March 8.	March 29.			
1 The Right Hon. the Lord Mayor of the City of Dublin (*Chairman*),	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	2	–	2
2 The High Sheriff of the City of Dublin (*Vice-Chairman*),	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	1	1	–	–	4	–	4
3 *Dr. J. Colclough-Hoey (*Master*),	1	1	1	1	1	1	1	1	1	1	1	–	1	1	1	a	–	–	–	–	–	–	–	–	–	–	–	–	8	6	14
4 *Frederic Wm. Kidd, esq., M.D (*Master*),	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	a	–	–	–	1	1	1	1	1	1	1	1	1	6	3	9
5 The Right Hon. Lord Ardilaun,	–	–	1	1	1	–	–	–	–	1	1	1	1	1	1	1	1	1	1	1	1	1	–	1	1	1	1	1	14	7	21
6 *James Fitzgerald Lombard, esq., J.P.,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	c	–	–	–	–	–	–	–	–	–
7 John Richardson, esq., J.P., D.L., Q.C.,	–	–	–	1	–	–	–	1	1	–	–	1	–	–	1	1	1	1	1	1	–	1	1	–	1	1	–	1	15	–	15
8 Edward Fottrell esq., J.P.,	–	–	–	1	–	1	1	1	1	–	1	1	–	1	–	1	1	–	1	1	–	1	–	–	–	1	–	1	15	2	17
9 John Summers, esq.,	–	1	1	1	–	1	1	1	1	–	1	1	–	1	–	1	1	–	1	1	–	1	–	–	–	1	–	1	15	2	17
10 Sir Charles A. Cameron, M.D.,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	1	–	–	–	–	–	–	–	–	–	3	–	3
11 *John Fox Goodman, esq., M.A., J.P.,	–	–	–	–	1	–	–	1	1	–	–	–	1	–	–	1	1	1	1	–	1	1	–	1	–	1	1	1	9	5	14
12 George H. Kidd, esq., M.D., (*Ex-Master*),	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	1	1	1	–	–	–	1	–	–	1	–	–	1	8	–	8
13 Sir John Banks, M.D., K.C.B.,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	1	–	–	–	–	1	1	–	1	5	–	5
14 *The Very Rev. Canon Daniel, P.P.,	1	1	1	1	1	1	1	–	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	–	1	1	1	1	17	8	25
15 *Rev. J. Dryden Smylie, M.A.,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	1	1	–	1	1	1	–	1	–	1	8	1	9
16 *Alderman Kernan,	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	1	1	1	–	1	1	–	–	–	–	–	–	5	2	7
17 Robert Callow, esq., J.P.,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	1	–	–	–	–	–	–	3	–	3
18 The Right Hon. the Earl of Meath,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
19 John Fleming, esq., J.P.,	–	1	–	1	–	1	–	–	1	–	1	1	–	1	1	1	1	1	1	1	–	1	1	–	1	1	–	1	18	–	18
20 William M. Murphy, esq., J.P., C.E.,	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	1
21 Samuel R. Mason, esq., M.D. (*Ex-Master*),	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	–	–	–	–	–	–	–	–	–	3	–	3
22 George Perry, esq. J.P.,	–	–	–	–	–	–	–	–	1	–	–	1	–	1	1	1	1	1	1	1	–	1	1	–	–	1	–	–	12	–	12
Total,	2	4	4	6	4	4	3	4	6	4	5	7	4	7	6	13	11	12	17	10	5	13	6	4	8	11	4	9	159	34	193

(*a*) Resigned 3rd November, 1893. (*b*) Elected 14th December, 1893. (*c*) Died 23rd December, 1893.

St. Mark's Ophthalmic and Aural Hospital and Dispensary.

Year ending 31st March, 1894.

Board of Governors.

The Right Hon. the Lord Mayor [for the time being, during his year of office].
*James Fitzgerald Lombard, Esq., J.P.
*Rev. Samuel Haughton, M.D., S.F.T.C.D
Rev. Abraham Stritch Fuller, D.D.
Sir George H. Porter, Bart., J.P., D.L.
*John B. Story, Esq., M.B., M.CH., F.R.C.S.I.
James Little, Esq., M.D., F.K.Q.C.P.I.
John Robert Mallins, Esq.
Sir Percy Raymond Grace, Bart., J.P., D.L.
William J. Goulding, Esq., M.A., J.P., D.L.
*Hamilton Drummond, Esq.
*Augustine F. Baker, Esq.
Michael J. Losty, Esq. T.C.

(Thus marked * are Trustees.)

Building Committee.
J. F. Lombard, Esq.
J. B. Story, Esq.
J. R. Mallins, Esq.

Finance Committee.
J. F. Lombard, Esq.
J. B. Story, Esq.
J. R. Mallins, Esq.
Sir Percy R. Grace.
Hamilton Drummond, Esq,
Rev. Dr. Haughton.

Hon. Secretary.—Augustine F. Baker. Esq.
Hon. Treasurer.—James F. Lombard, Esq.
Registrar and Accountant.—Mr. J. Wilson Hughes.

Return, showing the Attendances of each Governor at the several Meetings held during the year ended 31st March, 1894.

Number of Meetings summoned.	Date of Meeting, 1893–94.	1. Lord Mayor.	2. James F. Lombard, Esq.	3. Rev. Sml. Haughton, M.D., S.F.T.C.D.	4. Rev. A. S. Fuller, D.D.	5. Sir George H. Porter, Bart., M.D., D.L.	6. John B. Story, Esq., M.B.	7. James Little, Esq., M.D.	8. John R. Mallins, Esq.	9. Sir Percy R. Grace, Bt.	10. Wm. J. Goulding, Esq., J.P., D.L.	11. Daniel S. Bulger, Esq. T.C.	12. Hamilton Drummond Esq.	13. Augustine F Baker, Esq.	14. Michl. J. Losty, T.C.	One seat vacant.	Total Number of Governors Present.
	1893.																
1	April, 17,	–	1	1	–	–	1	–	1	–	–		1	–		–	5
2	May 1,	–	–	1	–	–	1	–	–	1	–		1	1		–	5*
3	„ 15,	–	1	–	–	–	1	–	1	–	–		–	–		–	3
4	June 19,	–	1	–	1	–	1	–	1	–	–		–	1		–	5
5	July 17,	–	1	1	–	–	1	–	–	1	–		1	1		–	6
6	Aug. 28,	–	–	1	–	–	1	–	–	1	–		–	–		–	3
7	Sept. 25.	–	–	–	–	–	1	–	1	–	–		1	1		–	4
8	Oct. 16,	–	1	–	1	–	1	–	1	–	1		1	1	1	–	8
9	„ 23,	–	1	1	–	–	1	–	1	–	1		1	1	1	–	8†
10	„ 30,	–	1	1	–	–	1	–	1	–	1		1	1	1	–	8‡
11	Nov. 20,	–	1	–	–	–	1	–	1	1	–		1	–	1	–	–
12	Dec. 18,	–	1	–	–	–	1	–	–	–	–		–	1	–	–	3
	1894.																
13	Jan. 15,	–	1	1	–	–	1	–	–	–	–		1	1	1	–	6
14	Feb. 19,	–	1	–	1	–	1	–	–	1	1		1	1	–	–	7
15	„ 26,	–	1	1	–	–	1	–	–	1	–		1	1	1	–	7†
16	March 12,	–	1	–	–	–	1	–	1	–	–		1	–	–	–	4*
17	„ 19,	–	1	–	1	–	1	–	–	–	1		–	–	–	–	4
	Total,	–	14	8	4	–	17	–	9	6	5	–	12	11	6	–	–

Resigned 16th December, 1893. Appointed 15th May, 1893.

* Finance Committee. † Special. ‡ Adjourned Meeting. 92

May, 1894. J. Wilson Hughes, *Registrar.*

Royal Hospital for Incurables.

Attendances of Governors.

Adair, S. F., J.P.	8
Adair, Mrs. S. F.	5
Barton, H. M.	2
Beater, Orlando	5
Beater, Orlando P., M.D.	5
Bennett, James C.	1
Bentley, John, J.P.	2
Bermingham, P. T.	5
Brady, Terence	3
Brady, Mrs. T.	2
Brooks, Maurice, D.L.	3
Brown, Vere W.	8
Brown, Walter,	2
Browne, Robert, M.D.	1
Browne, Mrs. E.	5
Burroughs, Rev. W. E., R.D.	3
Carey, Richard	9
Carolin, George O., J.P.	8
Carolin, Miss Ida	7
Carroll, J. Rawson, F.R.I.B.A.	9
Casson, George W., J.P.	8
Caulfield, Rev. F. M.	2
Corballis, R. J.	2
Corcoran, Miss K.	8
Cranny, John J., M.D.	13
Curtis, Thomas, J.P.	2
Daly, Miss H. R. G.	1
Daniel, Very Rev. Canon	3
Dillon, Rt. Hon. V. B. (Lord Mayor, 1894),	1
Dillon, Michael	4
Dillon, Miss Louisa	7
Doolin, Mrs. Walter	3
Drummond, David, J.P.	12
Drummond, Hamilton	4
Drummond, W. H.	1
Drumm, Thomas	9
Evans, W. R., M.D.	1
Eves, Graves S.	7
Faloon, W. H. Q.C.	3
Faerly, T. J.	1
Farrell, Thomas A.	4
Farrell, Hon. Mrs T. A.	4
Figgis, Edmund J.	11
Findlater, John, J.P.	2
Findlater, William, D.L.	6
Fitzgerald, Thomas	9
Fitzgerald, Miss	3
Fleming, John, J P.	7
Fottrell, Edward, J.P.	11
Fottrell, Miss	7
Fottrell, John G.	1
Fry, William	12
Fry, Miss M. L.	10
Fry, William, Junr., J.P.	6
Fry, Oliver	1
Garratt, W. A.	2
Geoghegan, W. J.	4
Gill, Alderman H. J., M.A.	1
Gilmore, John	6
Gleeson, P. M.	1
Glennon, Joseph	4
Good, Rev. Thomas, B.D.	11
Goodfellow, John S.	6
Goodlatte, E. R.	1
Hamilton, Samuel E., J.P.	3
Hanna, Mrs.	1
Hannan, Mrs. C.	3
Harding, Falkiner,	4
Hayes, William	8
Hewat, William,	2
Hewat, Mrs W.	2
Hogg, Jonathan	6
Horris, Rev. C., P.P.	6
Jellett, Rev. Canon	2
Johnson, Mrs.	2
Johnston, Francis	2
Johnston, Henry, C.E.	12
Johnston, Rev. H. F.	4
Jones, Miss	1
Kane, His Honor Judge	3
Kelly, Thomas A.	6
Kennedy, Charles	1
Kennedy, Francis	3
Kennedy, James	7
Kennedy, Louis,	4
Kiernan, Mrs.	1
Lalor, John J., J.P.	1
La Touche, J. J. Digges	1
Law, T. Pakenham, Q.C.	4
Law, Miss H. H.	2
Lawler, Charles, J.P.	1
Lentaigne, John, F.R.C.S.I.	4
Leonard, John, J.P.	1
Long, Edmond	4
Lynch, Mrs. John,	3
Lynch, Nicholas	7
Lynch, P.	2

Royal Hospital for Incurables.

Attendances of Governors—*con.*

McCabe, Miss K.	8	Radcliffe, Miss S. Weeks	4
McCann, James, J.P.	1	Read, Edward R.	3
McComas, Samuel, J.P.	6	Reid, J. Hamilton, M.A	2
McComas, William J.P. (the late)	7	Richardson, R. Delap	1
McDonald, James	5	Robinson, S. N.	1
McDonnell, John	1	Robinson, William	1
McSheehy, John	1	Ryland, Mrs.	4
McVittie, R. Blake, M.D.	4		
Macken, H. M.	2		
Maguire, Hugh	1		
Martin, Sir Richard, Bart.	1	Scott, James Edward, M.D.	1
Martin, Charles	1	Scally, Thomas	4
Martin, Mrs. C.	1	Searight, Graves E.	9
Martin, Miss K.	5	Sexton, Alfred R.	3
Matterson, Joseph, J.P.	1	Shanks, Right Hon. James (Lord Mayor, 1893)	1
Meade, Right Hon. J. M.	4	Sibthorpe, Thomas S., J.P.	8
Merriman, James	1	Smalldridge, Samuel, J.P.	3
Merry, James A.	4	Smith, Mrs.	7
Mitchell, Mrs. Alfred	7	Squires, W. A.	8
Mitchell, George,	1	Strickland, Mrs.	1
Molloy, W. R., M.R.I.A.	8	Sykes, James R.	2
Montgomery, Robert, M.D.	7		
Mooney, Edmund	5		
Mooney, Mrs. E.	5		
Mooney, John	6		
Moses, Marcus T	4	Taaffe, Mrs.	
Moses, Miss Amy,	1	Thrift, H. G.	2
Moses, Miss Ina,	1	Townshend, C. Uniacke, J.I.	4
Mulligan, John	5	Trouton, Charles R.	11
Murphy, Michael	3	Truell, H. P., M.B., F.R.C.S.I.	1
Murphy, Miss M.	2		
Neligan, Rev. Canon, D.D.	6	Vernon, Fane, J.P.	4
Nolan, Miss	2		
O'Brien, Miss	8	Wade, Gustavus R.	2
O'Connor, Hugh	6	Wade, Mrs, G. R.	7
Owens, Sir G. B, M D.	9	Wade, Miss F. M.	7
		Walsh, Rev. Canon, D.D.	3
		Ward, Joseph	3
Parkes, J. C.	2	Watson, William	12
Parkes, John	7	Watson, William, J.P.	1
Perry, George	2	Wheeler, W. Ireland, M.D., F.R.C.S.I.	4
Pigot, Thomas F.	1	White, W. Grove, LL.B.	5
Pim, James	3	White, Mrs. W. G.	4
Power, James Talbot, D.L.	2	Wilson, John A.	1
Purser, W. E.	5	Winter, Miss M.	6

Thomas Edward Grey,
Registrar.

No. 7,353.

Dublin Castle,
21st June, 1894.

Sir,

I have to acknowledge the receipt of your letter of the 13th instant, forwarding, for submission to His Excellency the Lord Lieutenant, the Report of the Board of Superintendence of the Dublin Hospitals for the year ended 31st March, 1894.

I am, Sir,

Your obedient Servant,

W. S. B. KAYE.

W. J. Martin, Esq., M.D
Secretary,
35, Dawson street.

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The Queen's Printing Office.

ROYAL COMMISSION ON ELECTRICAL COMMUNICATION WITH LIGHTHOUSES, &c.

SECOND REPORT

OF THE

ROYAL COMMISSION

APPOINTED TO INQUIRE WHAT

LIGHTHOUSES AND LIGHT-VESSELS

IT IS DESIRABLE TO CONNECT WITH THE

TELEGRAPHIC SYSTEM

OF THE

UNITED KINGDOM

BY

ELECTRICAL COMMUNICATION.

Presented to both Houses of Parliament by Command of Her Majesty.

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1894.

[C.—7338.] *Price* 1½*d.*

TABLE OF CONTENTS.

	Page.
ROYAL COMMISSIONS - - - - - - - - - - -	3
SECOND REPORT - - - - - - - - - - - -	7
APPENDIX - - - - - - - - - - - -	9

ROYAL COMMISSIONS.

I.

VICTORIA, R.

Victoria, by the Grace of God, of the United Kingdom of Great Britain and Ireland Queen, Defender of the Faith, to—

Our Right Trusty and Right Well-beloved Cousin and Councillor, William Henry, Earl of Mount-Edgcumbe; Our Trusty and Well-beloved Sir Edward Birkbeck, Baronet; Our Trusty and Well-beloved Sir Francis Leopold M'Clintock, Knight Commander of Our Most Honourable Order of the Bath, Admiral on the Retired List of Our Navy; Our Trusty and Well-beloved Sir George Strong Nares, Knight Commander of Our Most Honourable Order of the Bath, Rear Admiral on the Retired List of Our Navy; Our Trusty and Well-beloved John Cameron Lamb, Esquire, Companion of Our Most Distinguished Order of Saint Michael and Saint George; Our Trusty and Well-beloved Ronald Craufurd Munro-Ferguson, Esquire; Our Trusty and Well-beloved Edward Graves, Esquire; Our Trusty and Well-beloved John Arrow Kempe, Esquire; and Our Trusty and Well-beloved Henry Lyle Mulholland, Esquire, Greeting!

Whereas We have deemed it expedient that a Commission should forthwith issue to inquire and report what Lighthouses and Light-vessels it is desirable to connect with the telegraphic system of the United Kingdom by electrical communication, for the purpose of giving information of vessels in distress or casualties at sea to places from which assistance could be sent, and of transmitting storm warnings, having due regard to the practicability of establishing and maintaining such communication without impairing the efficiency of the Light Service, and at a cost bearing a reasonable proportion to the advantages that might be expected to result; and to suggest the manner in which such communication should be established wherever it might be recommended.

Now know ye, that We, reposing great trust and confidence in your knowledge and ability, have authorised and appointed, and do by these presents authorise and appoint you the said William Henry, Earl of Mount-Edgcumbe; Sir Edward Birkbeck; Sir Francis Leopold M'Clintock; Sir George Strong Nares; John Cameron Lamb; Ronald Craufurd Munro-Ferguson; Edward Graves; John Arrow Kempe; and Henry Lyle Mulholland; to be Our Commissioners for the purposes of the said inquiry.

And for the better effecting the purposes of this Our Commission, We do by these presents give and grant unto you, or any three or more of you, full power to call before you such persons as you shall judge likely to afford you any information upon

the subject of this Our Commission; and also to call for, have access to, and examine all such books, documents, registers, and records as may afford you the fullest information on the subject; and to inquire of and concerning the premises by all other lawful ways and means whatsoever.

And We do by these presents authorise and empower you, or any three or more of you, to visit and personally inspect such places as you may deem it expedient so to inspect for the more effectual carrying out of the purposes aforesaid.

And We do further by these presents will and ordain that this Our Commission shall continue in full force and virtue, and that you, Our said Commissioners, or any three or more of you, may from time to time proceed in the execution thereof, and of every matter and thing therein contained, although the same be not continued from time to time by adjournment.

And We do further ordain that you, or any three or more of you, have liberty to report your proceedings under this Our Commission from time to time, if you shall judge it expedient so to do.

And Our further will and pleasure is, that you do, with as little delay as possible, report to Us, under your hands and seals, or under the hands and seals of any three or more of you, your opinion upon the matter herein submitted for your consideration.

And for the purpose of aiding you in such matters, We hereby appoint our Trusty and Well-beloved Garnham Roper, Esquire, to be Secretary to this Our Commission.

Given at Our Court at Saint James's the thirteenth day of June, one thousand eight hundred and ninety-two, in the fifty-fifth year of our Reign.

By Her Majesty's Command,
(Signed) HENRY MATTHEWS.

II.

VICTORIA, R.

Victoria, by the Grace of God, of the United Kingdom of Great Britain and Ireland Queen, Defender of the Faith, to—

Our Trusty and Well-beloved William Henry Preece, Esquire, Engineer-in-Chief and Electrician to the General Post Office, Fellow of the Royal Society, Greeting!

Whereas We did, by Warrant under Our Royal Sign Manual, bearing date the thirteenth day of June, one thousand eight hundred and ninety-two, appoint our Right Trusty and Right Well-beloved Cousin and Councillor, William Henry, Earl of Mount-Edgcumbe, together with the several Gentlemen therein respectively mentioned, or any three or more of them, to be Our Commissioners to inquire and report what Light-houses and Light-vessels it is desirable to connect with the telegraphic system of the United Kingdom by electrical communication, for the purpose of giving information of vessels in distress or casualties at sea to places from which assistance could be sent, and of transmitting storm warnings, having due regard to the practicability of establishing and maintaining such communication without impairing the efficiency of the Light Service, and at a cost bearing a reasonable proportion to the advantages that might be expected to result; and to suggest the manner in which such communication should be established wherever it might be recommended:

And whereas one of Our Commissioners so appointed, namely, Edward Graves, Esquire, has since deceased:

Now know ye, that We, reposing great confidence in you, do by these presents appoint you, the said William Henry Preece, to be one of Our Commissioners for the purpose aforesaid in the room of the said Edward Graves, deceased, in addition to and together with the other Commissioners whom We have already appointed.

Given at Our Court at Saint James's the twenty-sixth day of November one thousand eight hundred and ninety-two, in the fifty-sixth year of Our Reign.

By Her Majesty's Command,
(Signed) H. H. ASQUITH.

III.

VICTORIA, R.

Victoria, by the Grace of God of the United Kingdom of Great Britain and Ireland Queen, Defender of the Faith, to—

Our Right Trusty and Right Well-beloved Cousin and Councillor, William Henry, Earl of Mount Edgcumbe; Our Trusty and Well-beloved Sir Edward Birkbeck, Baronet; Our Trusty and Well-beloved Sir Francis Leopold M'Clintock, Knight Commander of Our Most Honourable Order of the Bath, Admiral on the Retired List of Our Navy; Our Trusty and Well-beloved Sir George Strong Nares, Knight Commander of Our Most Honourable Order of the Bath, Rear Admiral on the Retired List of Our Navy; Our Trusty and Well-beloved John Cameron Lamb, Esquire, Companion of Our Most Distinguished Order of Saint Michael and Saint George; Our Trusty and Well-beloved Ronald Craufurd Munro-Ferguson, Esquire; Our Trusty and Well-beloved John Arrow Kempe, Esquire; and Our Trusty and Well-beloved Henry Lyle Mulholland, Esquire, Greeting!

Whereas We were pleased by Warrant under Our Royal Sign Manual, bearing date the thirteenth day of June one thousand eight hundred and ninety-two, constituting you Our Commissioners to inquire and report what Lighthouses and Light-vessels it is desirable to connect with the telegraphic system of the United Kingdom by electrical communication, for the purposes set forth in the said Warrant, and to suggest the manner in which such communication should be established wherever it might be recommended, to appoint Our Trusty and Well-beloved Garnham Roper, Esquire, to be Secretary to the said Commission:

And whereas the said Garnham Roper has resigned such appointment:

Now know ye, that in the room of the said Garnham Roper, We have made choice of Our Trusty and Well-beloved Ernest Grant Moggridge, Esquire, to be Secretary to such Commission, whose services and assistance We require you to avail yourselves of, from time to time, as occasion may require.

Given at Our Court at Saint James's the twenty-first day of June one thousand eight hundred and ninety-three, in the fifty-seventh year of Our Reign.

By Her Majesty's Command,
(Signed) H. H. ASQUITH.

SECOND REPORT.

TO THE QUEEN'S MOST EXCELLENT MAJESTY.

MAY IT PLEASE YOUR MAJESTY,

WE, the undersigned Commissioners appointed "to inquire and report what "lighthouses and light-vessels it is desirable to connect with the telegraphic system "of the United Kingdom by electrical communication, for the purpose of giving "information of vessels in distress or casualties at sea to places from which assistance "could be sent, and of transmitting storm-warnings," desire humbly to present to Your Majesty a Second Report upon the inquiry entrusted to us, together with certain recommendations respecting Shore Lighthouses.

Since the issue of our First Report, we have made a further tour of inspection of lighthouses and light-vessels.

On the 10th July 1893, we assembled at Glengariff, Bantry Bay. On the following morning we embarked on board the steamer "Moya," which was placed at our disposal by the Commissioners of Irish Lights, and inspected the Bull Rock and the Fastnet. Leaving the "Moya" at Baltimore, we proceeded to Cork, and thence to Kingstown, where we embarked on board H.M.S. "Enchantress."

On the morning of the 13th July we proceeded to the Isle of Man, landed at the Chicken Rock Lighthouse, and, passing Langness Lighthouse and the Bahama Bank Light-vessel, anchored in Ramsey Bay. On the following day we crossed from the Isle of Man to Bangor, county Down, passing the South Rock and Skulmartin Rock Light-vessels and Mew Island Lighthouse. On the 15th July we proceeded to Lamlash, landing on the way at the Maidens and Ailsa Craig Lighthouses. After having visited Pladda Island Lighthouse, we landed on the 17th July on Sanda Island and Rathlin Island, inspecting the lighthouses on those two islands, and anchored for the night in Lough Foyle. From Lough Foyle we proceeded to Oban, after having inspected the lighthouse on Inishtrahull Island, and from Oban we steamed through the Sound of Sleat to Stornoway. Returning to the mainland, we anchored at Loch Inver, and visited the Ru Stoer Lighthouse, and on the 24th July we left Loch Inver for Longhope in the Orkney Islands, whence we paid a visit to the Cantick Lighthouse and to the Look-out Station of the Commissioners of Northern Lighthouses on Brough Ness, opposite to the Pentland Skerries Lighthouses. On the 26th July we inspected Stroma and disembarked at Scrabster. Then proceeding south by train to Seahouses, we embarked on board the Trinity House steamer "Argus," which conveyed us round the Farn Islands. The tour of inspection ended with the visit to the lighthouses on those islands.

We re-assembled in London in September, and have since held several meetings.

Although the general question of signalling had not been directly referred to us, it appeared to be so intimately connected with the subject of electrical communication that we felt ourselves justified in considering it, and in our First Report we stated that in cases "where the distance from the shore is not great, an improved system of "distress-signals (distinct from the usual fog-signals) might, both at rock stations "and on light-vessels, prove an effective temporary substitute for the more costly "expedient of electrical communication."

This view has been confirmed by the experience which we gained during our last tour of inspection, and we are now prepared to go further and recommend that the General Lighthouse Authorities should be invited to consider the subject with the view of instituting a universal system of visual and sound signals at all the various light stations on the coasts of Great Britain and Ireland.

A Member of the Commission, Sir Edward Birkbeck, having occasion last spring to visit the United States of America, we requested him to take the opportunity of inquiring into the systems of coast communication in force in Canada and the United States.

On his return to this country, Sir Edward Birkbeck, submitted to us a report, a copy of which will be found in the Appendix. From that report it will be seen that, while both Canada and the United States possess an efficient system of electrical communication round their coasts, none of the light-vessels belonging to those countries had been electrically connected with the mainland.

We have received and considered particulars of a number of inventions for effecting electrical communication between light-vessels and the shore, but none of these are in our opinion preferable to the "Sunk" system which is now being applied to the Goodwin (North Sand Head) and Kentish Knock Light-vessels.

We have again to express our obligation to the Admiralty for the loan of H.M.S. "Enchantress," and to the Trinity House, the Commissioners of Irish Lights, and the Commissioners of Northern Lighthouses for the assistance which they have rendered to us.

Recommendations.

We recommend that electrical communication by aërial wires be established without delay between the telegraphic system of the country, and the following *Shore Lighthouses and Lighthouse Stations.*

Name of Lighthouse.	To be connected by Telephone with	Estimated Cost (approximate).	Remarks.
		£	
Falmouth Harbour	Portscatho C.G.S.	160	
Souter Point	Whitburn C.G.S.	100	
Montrose (Scurdy Ness)	Usan C.G.S.	85	
Covesea Skerries	Lossiemouth P.O.	83	
Tarbet Ness	Portmahomack P.O.	55	If Admiralty wire is used.
Look-out Station at Brough Ness for Pentland Skerries Lighthouses.	St. Margaret's Hope P.O.	233	
Fair Isle (North end)	Fair Isle P.O.	128	
Sumburgh Head (Shetland Islands).	Sumburgh P.O.	65	
Cape Wrath	Durness P.O.	20	If Admiralty wire is used.
Ru Stoer	Stoer P.O.	20	If Admiralty wire is used.
Rhynns of Islay (Oversay Island).	Bruichladdich P.O.	330	
Turnberry	Maidens P.O.	48	
St. Bees	St. Bees P.O.	76	If Admiralty wire is used.
Langness	Castletown P.O.	103	
Menai	Beaumaris P.O., and Lifeboat Coxswain's house at Penmon.	72	
South Stack	Holyhead C.G.S.	15	
Galley Head	Dunny Cove C.G.S.	150	
Loop Head Kilcradan Point	Carrigaholt P.O.	61	If Admiralty wire is used.
	Total	£1,804	

It is with regret that we have decided to confine our recommendations in this Report to Shore Lighthouses, but, until more has been done towards effecting the connexion of those light-vessels and lighthouses, which were selected in our First Report as having the strongest claims to immediate attention, we hesitate to add to the list of light-vessels and island and rock lighthouses, with which we consider that electrical communication should be established.

All which we humbly submit for Your Majesty's gracious consideration.

(Signed) MOUNT-EDGCUMBE (*Chairman*).
HENRY LYLE MULHOLLAND.
EDWARD BIRKBECK.
F. L. M'CLINTOCK.
G. S. NARES.
W. H. PREECE.
J. C. LAMB.
JOHN A. KEMPE.
R. MUNRO-FERGUSON.

(Signed) Ernest G. Moggridge,
Secretary.

March 1894.

APPENDIX.

Report of Sir Edward Birkbeck on the System of Coast Communication in Canada and the United States.

I have the honour to report that, in accordance with the desire expressed by the Royal Commission on Electrical Communication with Lighthouses, &c., at their meeting held on 20th March, I proceeded, after the termination of my official visit to Chicago, to obtain, both by inquiry and by personal inspection, some information in regard to the telegraphic and telephonic system of coast communication now in force on certain portions of the coast of Canada and the United States.

The request addressed by the Secretary of the Royal Commission to the Colonial and Foreign Offices that those Departments should ask that facilities might be given to me by the Governments of the Dominion of Canada and of the United States secured for me great assistance in my work of investigation.

Canada.

On my arrival at Ottawa Mr. William Smith, Deputy Minister of Marine, gave me a most exhaustive explanation of the working of the coast telegraphic system of the Dominion. He was desirous that I should visit the life-saving station on Sable Island, but thought it still more important that I should inspect a first-class lighthouse signal station commanding, during the navigation season, the largest amount of passing shipping.

The S.S. "La Canadienne" was therefore ordered to meet me at Dalhousie on the coast of New Brunswick, and to convey me to any portions of the coast that I desired to visit. I accordingly proceeded from that place early on the morning of the 25th May in a north-easterly direction up the Gulf of St. Lawrence, passing the lighthouse signal stations on Macquereau Point and Cape Despair, and landing the same evening at Cape Rosier, a first-class lighthouse signal station.

Cape Rosier Lighthouse.

This lighthouse, which was established in 1858, is situated on a low cliff, and has a fixed white light 136 feet above high-water mark, with a range of visibility of 17 miles. The position is one of great importance for a signal station, and a large amount of shipping passes within signalling distance, bound either to or from Europe, Nova Scotia, or the United States, including, in the summer season, steamers proceeding through the straits of Belle Isle to Quebec and Montreal.

The lighthouse keeper at this station receives 800 dollars per annum, and has to pay his assistant out of this sum. He is allowed to employ more than one assistant if he desires, but he must do so at his own cost.

During the time the navigation is open—generally from about 1st April to 10th or 20th December—the keeper and his assistant are responsible for the performance of the following duties:—

(1.) Lighting and cleaning the lamps.
(2.) Managing the boiler and engine for sounding the steam horn.
(3.) Painting the inside and outside of the lighthouse.
(4.) Taking entire charge of the telegraph (Morse) instrument.
(5.) Reporting to Quebec twice a day the state of the weather.
(6.) Reporting all ships passing the station.
(7.) Telegraphing for tugs to assist disabled vessels.
(8.) Forwarding any public or private telegrams which may be handed in.

Private messages handed in can be paid for either by the sender or receiver, and at some of the signal stations a very considerable amount of telegraph business is transacted during the summer months for trade purposes.

The lighthouse keeper's son had charge of the telegraph instrument, and the call bell is placed within hearing of the principal room used by the family, the instrument being in a small room on the ground floor. I inspected everything connected with the telegraphic portion of the keeper's duties, and found all in perfect order.

At night we steamed passed Fame Point Lighthouse Signal Station, and proceeded to the Island of Anticosti, situated 65 miles from the mainland of the Province of Quebec, 107 miles from Newfoundland and 40 miles from the coast of Labrador. The island is connected by cable with the mainland near Cape Rosier, and also with the coast of Labrador.

I landed at West Point Lighthouse Signal Station at 4 a.m. on 26th May, and inspected that lighthouse, which was established in 1858, and is situated on low land. It is furnished with a fixed white light 106 feet above high water-mark visible 15 miles. West Point Lighthouse.

This is one of four first-class lighthouse signal stations, all situated on the south-west coast of the island. They are much needed on this dangerous coast, and are of great importance both as signal stations and for furnishing reports regarding the weather, and also regarding the state of the ice at the beginning and end of the navigation season.

The lighthouse keeper at West Point has two assistants, both paid by himself, with duties similar to those at Cape Rosier Lighthouse, except that a large gun is used in foggy weather instead of a foghorn.

The signal station at Heath Point Lighthouse is the most important of the four for signalling purposes, but on inspecting the return of commercial messages handed in during the year at West Point Station, I found numerous entries proving that even at that most out-of-the-way station coast communication is of importance to the trading community.

A westerly gale, accompanied with snow and rain, made it impracticable to land at the East Cape Lighthouse Signal Station, but I was informed that the arrangements there are similar to those at the West Point Station.

The Canadian Government have established a complete and thorough system of telegraphic coast communication, and have also provided cable communication with every island of importance with the exception of Sable Island, which will be connected in due course. The telegraphic, instead of the telephonic, system has been adopted on account of the number of commercial messages which have to be sent, and the long distance which the messages have to be transmitted.

Many of the Canadian light-vessels have to be moved from their stations during the winter on account of the ice, and the question of cable communication with them has not been taken in hand.

The following statement was prepared for me by the Telegraph Department at Ottawa:—

"It is the practice of the Government Telegraph Service to operate its lines locally through district superintendents acting under instructions from the head office at Ottawa, as different conditions are found to exist in the different sections, and the requirements of the service can best be ascertained by local supervision.

"A book of rules for the guidance of the employés generally was issued in 1889 after the working of the entire system for several years had developed what was most advantageous and best calculated to facilitate the business of the service.

"In the matter of repairs. On land lines less than 200 miles in extent a general lineman is employed, whose duty is to go over the line periodically and, with assistance when needed, put the whole in good order. In case of an interruption the agent at the nearest office goes or sends some one to make temporary repair. Permanent repair is made by the lineman as early as practicable.

"As regards the maintenance of cables. All tests and repairs should as far as practicable be made by or under the supervision of one electrician, in order that the behaviour of, and conditions obtaining in, the different lengths may be followed up and understood by him. This practice has as closely as possible been adhered to by us.

"Sometimes a cable is known to have been seriously damaged by ice grounding on the shore ends, just about the time of an interruption occurring. In such case the local officer is authorised to pick up and examine the cable at the point in question, and to make such temporary repairs as he can by removing the armour wires, and in the most convenient way reinsulating the conductor should the latter be found exposed. As an instance in point this was done at South-west Point,

Anticosti, by our district superintendent, Mr. Pope, last month; and we have had uninterrupted communication which would otherwise have ceased until a new piece of cable could be spliced in.

"The S.S. 'Newfield' has been provided with the necessary appliances for raising, repairing, and relaying the cables in the gulf, and is always called upon for the making of permanent repairs.

"In event of a fault or break occurring whose whereabouts is unknown, the electrician from headquarters proceeds with the "Newfield" as early as practicable to locate the trouble and effect repairs.

"In the River St. Lawrence and in the lakes a tug boat, with sometimes a scow accompanying, is temporarily hired for the work of laying and repairing."

United States.

On Wednesday, 30th May, I called on Captain Charles A. Abbey, Inspector of Life-saving Stations for the United States, at his office in New York.

Captain Abbey, who had been instructed by the Government at Washington to render me assistance during my visit, gave me all possible information respecting the telephonic service at the Life-saving stations, as well as regarding the Life-saving Service itself.

In accordance with the suggestion of the United States Government, which I received through Sir Julian Pauncefote, I proceeded on the following morning with Captain Abbey to the coast of New Jersey State. We landed near Sandy Hook, and went thence by rail to Seabright Life-saving Station.

It is important to observe, that with the exception of the 10 stations on the Pacific coast, and those round the shores of the great lakes during the season of open navigation, the staff at the Life-saving stations are, from the 1st May to 1st September, all disbanded, the keeper alone being left in charge to work the telephone.

Orders had, however, been given by the United States Government, to summon the surfmen at Seabright Station, in order that I might see everything in full working order.

Seabright Station.

I found this first-class station thoroughly organised and fully equipped in every detail. A very commanding place of look-out is provided on the roof, from which vessels in distress can be seen for a considerable distance, and telephonic communication can be effected with any one of the stations on the coast within 70 miles, by means of switches.

The telephone is placed in the keeper's room, but the call bell can be heard in all parts of the building, and is immediately answered by the person on duty. Practical tests were carried out in my presence at this station.

The keepers were loud in their praises of the advantages of the system for life-saving purposes, and stated that in the winter, distant stations are often warned in advance to be prepared for an emergency. The wire is carried on iron poles from the stations to the nearest system of wires—generally following the coast line—and where telegraph poles are not already available, iron ones are erected in close proximity to the shore, and to the life-saving stations on either side. The cost of running a wire from station to station is on an average (according to information given me by the District Superintendent of Telephones), say 75 dollars a mile, without the instruments.

Great importance is attached to the principle of running the wires direct from station to station, and not using existing lines many miles inland, and then returning to the coast, as has been done in many cases in England, thus making it necessary to call up the postmaster at night.

The United States Government allow the station telephones to be used by the general public in cases where there is no telegraph office near, and messages are forwarded by the station keepers to the telegraph offices, payment being collected from the receivers of the messages.

The surfmen at each station—six in number, in addition to the keeper—patrol the coast day and night in either direction in a similar way to the coastguardmen, but at present there is no means for the patrol to call the immediate attention of the station and report a vessel in distress, and he may have three or four miles to wade through deep snow or sand to reach the station. I think that a great advantage would be gained if an arrangement was provided at stated intervals enabling the patrol to touch a "button" and thus warn the station to prepare for immediate service, and the surfmen informed me that such a system would add greatly to the efficiency of the Life-saving Service, as the patrol often arrives at the station exhausted and almost unfit to go out in a life-boat. Captain Abbey entirely endorsed this opinion.

Among other duties performed by the surfmen when on patrol in out-of-the-way districts is carrying letters in order to expedite their delivery.

I visited three other stations, viz.:—

(1.) Monmouth Beach.
(2.) Long Branch.
(3.) Deal.

The arrangements, so far as coast communication is concerned, at these and at all the other stations are very similar to those at Seabright, which I have described.

I may add that the system of telephonic communication in connexion with the Life-saving Service on the shores of the great lakes during the navigation season is of an equally efficient character, and the necessity for this is apparent when the extent of the lake trade is considered, the annual import and export tonnage for the port of Chicago alone, on Lake Michigan, being larger than that of New York.

No cable communication from the shore to light-vessels has yet been established, but wires are laid to the electric buoys wherever they are placed, no ships being allowed to anchor near them.

I have, however, reason to believe that the United States Government are about to consider the desirability of cable communication between the mainland and some of the light-vessels and rock and island lighthouses, with none of which does communication at present exist for life-saving purposes.

In conclusion I would remark that the Canadian telegraphic coast communication arrangements appear to me to be carried out in a most efficient manner, and to be of great use to the Government and general public, and considering the many duties which the lighthouse keepers have to perform with so small a staff to assist them, it was most striking to see the great interest they take in their extra work of telegraphy and how cheerfully they perform it.

These facts lead me to venture to think that the Royal Commission will have no hesitation in recommending that more lighthouses be telephonically connected with the Post Office system on certain parts of our coasts.

From the inquiries I made in the United States, at the Government establishment at the World's Fair under Lieutenant Charles H. McLellan, from the information I gained from Captain Abbey, and from my inspection of the stations on the New Jersey coast, to which I have referred, I am convinced that the system of telephonic coast communication now in force in the United States is a very admirable one, and I am of opinion that the maximum of efficiency would be secured if in due course the system of direct lines running along the coast could be adopted in this country, instead of the zigzag system of communication through inland post offices, which necessarily at night involves loss of time, a matter in some cases of vital importance.

I would suggest that the thanks of the Royal Commission should be conveyed to the Governments of Canada and the United States for the courtesy which was shown to me, and for the great assistance and facilities granted to me in the inspection, which I had the honour to make on behalf of the Royal Commission, of the systems of coast communication in those two countries.

The thanks of the Commission are in particular due to the following officials:—

(1.) Mr. William Smith, Deputy Minister of Marine and Fisheries, Ottawa.
(2.) Mr. Summer I. Kimball, General Superintendent of the United States Life-saving Stations, Washington.
(3.) Captain Charles A. Abbey, Inspector of Life-saving Stations, 24, State Street, New York.
(4.) Lieutenant Charles H. McLellan, in charge of the United States Life-saving Exhibits at the World's Fair, and Assistant Inspector of the Fourth District.
(5.) Captain Bélanger, in command of the Canadian Government S.S. "La Canadienne."

(Signed) Edward Birkbeck.

June 1893.

ELECTRICAL STANDARDS COMMITTEE.

SUPPLEMENTARY REPORT

AND

FINAL REPORT

OF THE

ELECTRICAL STANDARDS COMMITTEE.

Presented to both Houses of Parliament by Command of Her Majesty.

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Supplementary Report of the Electrical Standards Committee.

To the Right Hon. A. J. MUNDELLA, M.P., President of the Board of Trade.

Subsequently to the presentation of our former Report to Sir Michael Hicks-Beach in July 1891, we were informed that it was probable that the German Government would shortly take steps to establish legal standards for use in connexion with electrical supply, and that, with a view to secure complete agreement between the proposed standards in Germany and England, the Director of the Physico Technical Imperial Institute at Berlin, Professor Von Helmholtz, with certain of his assistants, proposed to visit England for the purpose of making exact comparisons between the units in use in the two countries, and of attending the meeting of the British Association which was to take place in August in Edinburgh.

Having regard to the importance of this communication, it appeared desirable that the Board of Trade should postpone the action recommended in our previous Report until after Professor Helmholtz's visit.

That visit took place early in August, and there was a very full discussion of the whole subject at the meeting of the British Association in Edinburgh, at which several of our number were present. The meeting was also attended by Dr. Guillaume, of the Bureau International des Poids et Mesures, and Professor Carhart, of the University of Michigan, U.S.A., who were well qualified by their scientific attainments to represent the opinion of their respective countries.

It appeared from the discussion that a few comparatively slight modifications of the resolutions included in our previous Report would tend to secure international agreement.

An extract from the Report of the Electrical Standards Committee of the British Association embodying the results of this discussion was communicated to us by the Secretary, and will be found in the Appendix to this Report.

Having carefully reconsidered the whole question in view of this communication, and having received the Report of the sub-committee mentioned in resolution 14 of our previous Report, we now desire, for the resolutions contained in that Report, to substitute the following :—

Resolutions.

1. That it is desirable that new denominations of standards for the measurement of electricity should be made and approved by Her Majesty in Council as Board of Trade standards.

2. That the magnitudes of these standards should be determined on the electro-magnetic system of measurement with reference to the centimetre as unit of length, the gramme as unit of mass, and the second as unit of time, and that by the terms centimetre and gramme are meant the standards of those denominations deposited with the Board of Trade.

3. That the standard of electrical resistance should be denominated the ohm, and should have the value 1,000,000,000 in terms of the centimetre and second.

4. That the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice 14·4521 grammes in mass of a constant cross sectional area, and of a length of 106·3 centimetres may be adopted as one ohm.

5. That a material standard, constructed in solid metal, should be adopted as the standard ohm, and should from time to time be verified by comparison with a column of mercury of known dimensions.

6. That for the purpose of replacing the standard, if lost, destroyed, or damaged, and for ordinary use, a limited number of copies should be constructed, which should be periodically compared with the standard ohm.

7. That resistances constructed in solid metal should be adopted as Board of Trade standards for multiples and submultiples of the ohm.

8. That the value of the standard of resistance constructed by a committee of the British Association for the advancement of science in the years 1863 and

1864, and known as the British Association unit, may be taken as ·9866 of the ohm.

9. That the standard of electrical current should be denominated the ampere, and should have the value of one-tenth (0·1) in terms of the centimetre, gramme, and second.

10. That an unvarying current which, when passed through a solution of nitrate of silver in water, in accordance with the specification attached to this Report, deposits silver at the rate of 0·001118 of a gramme per second, may be taken as a current of one ampere.

11. That an alternating current of one ampere shall mean a current such that the square root of the time average of the square of its strength at each instant in amperes is unity.

12. That instruments constructed on the principle of the balance, in which by the proper disposition of the conductors, forces of attraction and repulsion are produced, which depend upon the amount of current passing, and are balanced by known weights, should be adopted as the Board of Trade standards for the measurement of current whether unvarying or alternating.

13. That the standard of electrical pressure should be denominated the volt, being the pressure which, if steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere.

14. That the electrical pressure at a temperature of 15° centigrade between the poles or electrodes of the voltaic cell known as Clark's cell, prepared in accordance with the specification attached to this report, may be taken as not differing from a pressure of 1·434 volts, by more than one part in one thousand.

15. That an alternating pressure of one volt shall mean a pressure such that the square root of the time average of the square of its value at each instant in volts is unity.

16. That instruments constructed on the principle of Lord Kelvin's Quadrant Electrometer used idiostatically, and, for high pressures, instruments on the principle of the balance, electrostatic forces being balanced against a known weight, should be adopted as Board of Trade standards for the measurement of pressure, whether unvarying or alternating.

(Signed) COURTENAY BOYLE.
KELVIN.
P. CARDEW.
W. H. PREECE.
RAYLEIGH.
G. CAREY FOSTER.
R. T. GLAZEBROOK.
J. HOPKINSON.
W. E. AYRTON.

(Signed) T. W. P. BLOMEFIELD,
Secretary.

29th November 1892.

SPECIFICATION REFERRED TO IN RESOLUTION 10.

In the following specification the term silver voltameter means the arrangement of apparatus by means of which an electric current is passed through a solution of nitrate of silver in water. The silver voltameter measures the total electrical quantity which has passed during the time of the experiment, and by noting this time the time-average of the current, or if the current has been kept constant, the current itself, can be deduced.

In employing the silver voltameter to measure currents of about 1 ampere, the following arrangements should be adopted. The kathode on which the silver is to be deposited should take the form of a platinum bowl not less than 10 cm. in diameter, and from 4 to 5 cm. in depth.

The anode should be a plate of pure silver some 30 square cm. in area and 2 or 3 millimetres in thickness.

This is supported horizontally in the liquid near the top of the solution by a platinum wire passed through holes in the plate at opposite corners. To prevent the disintegrated silver which is formed on the anode from falling on to the kathode, the anode should be wrapped round with pure filter paper, secured at the back with sealing wax.

The liquid should consist of a neutral solution of pure silver nitrate, containing about 15 parts by weight of the nitrate to 85 parts of water.

The resistance of the voltameter changes somewhat as the current passes. To prevent these changes having too great an effect on the current, some resistance besides that of the voltameter should be inserted in the circuit. The total metallic resistance of the circuit should not be less than 10 ohms.

Method of making a Measurement.

The platinum bowl is washed with nitric acid and distilled water, dried by heat, and then left to cool in a desiccator. When thoroughly dry it is weighed carefully.

It is nearly filled with the solution, and connected to the rest of the circuit by being placed on a clean copper support to which a binding screw is attached. This copper support must be insulated.

The anode is then immersed in the solution so as to be well covered by it and supported in that position; the connexions to the rest of the circuit are made.

Contact is made at the key, noting the time of contact. The current is allowed to pass for not less than half an hour, and the time at which contact is broken is observed. Care must be taken that the clock used is keeping correct time during this interval.

The solution is now removed from the bowl and the deposit is washed with distilled water and left to soak for at least six hours. It is then rinsed successively with distilled water and absolute alcohol and dried in a hot-air bath at a temperature of about 160° C. After cooling in a desiccator it is weighed again. The gain in weight gives the silver deposited.

To find the current in amperes, this weight, expressed in grammes, must be divided by the number of seconds during which the current has been passed, and by ·001118.

The result will be the time-average of the current, if during the interval the current has varied.

In determining by this method the constant of an instrument the current should be kept as nearly constant as possible, and the readings of the instrument taken at frequent observed intervals of time. These observations give a curve from which the reading corresponding to the mean current (time-average of the current) can be found. The current, as calculated by the voltameter, corresponds to this reading.

Specification referred to in Resolution 14.

Definition of the Cell.

The cell consists of zinc and mercury in a saturated solution of zinc sulphate and mercurous sulphate in water, prepared with mercurous sulphate in excess, and is conveniently contained in a cylindrical glass vessel.

Preparation of the Materials.

1. *The Mercury.*—To secure purity it should be first treated with acid in the usual manner, and subsequently distilled in vacuo.

2. *The Zinc.*—Take a portion of a rod of pure redistilled zinc, solder to one end a piece of copper wire, clean the whole with glass paper, carefully removing any loose pieces of the zinc. Just before making up the cell dip the zinc into dilute sulphuric acid, wash with distilled water, and dry with a clean cloth or filter paper.

3. *The Zinc Sulphate Solution.*—Prepare a saturated solution of pure ("pure re-crystallised") zinc sulphate by mixing in a flask distilled water with nearly twice its weight of crystals of pure zinc sulphate, and adding zinc oxide in the proportion of

about 2 % by weight of the zinc sulphate crystals to neutralise any free acid.* The crystals should be dissolved with the aid of gentle heat, but the temperature to which the solution is raised should not exceed 30° C. Mercurous sulphate treated as described in 4 should be added in the proportion of about 12 % by weight of the zinc sulphate crystals, and the solution filtered, while still warm, into a stock bottle. Crystals should form as it cools.

4. *The Mercurous Sulphate.*—Take mercurous sulphate, purchased as pure, and wash it thoroughly with cold distilled water by agitation in a bottle; drain off the water, and repeat the process at least twice.* After the last washing drain off as much of the water as possible.

Mix the washed mercurous sulphate with the zinc sulphate solution, adding sufficient crystals of zinc sulphate from the stock bottle to ensure saturation, and a small quantity of pure mercury. Shake these up well together to form a paste of the consistence of cream. Heat the paste, but not above a temperature of 30° C. Keep the paste for an hour at this temperature, agitating it from time to time, then allow it to cool; continue to shake it occasionally while it is cooling. Crystals of zinc sulphate should then be distinctly visible, and should be distributed throughout the mass; if this is not the case add more crystals from the stock bottle, and repeat the whole process.

This method ensures the formation of a saturated solution of zinc and mercurous sulphates in water.

Contact is made with the mercury by means of a platinum wire about No. 22 gauge. This is protected from contact with the other materials of the cell by being sealed into a glass tube. The ends of the wire project from the ends of the tube; one end forms the terminal, the other end and a portion of the glass tube dip into the mercury.

To set up the Cell.

The cell may conveniently be set up in a small test tube of about 2 cm. diameter, and 6 or 7 cm. deep. Place the mercury in the bottom of this tube, filling it to a depth of say 1·5 cm. Cut a cork about ·5 cm. thick to fit the tube; at one side of the cork bore a hole through which the zinc rod can pass tightly; at the other side bore another hole for the glass tube which covers the platinum wire; at the edge of the cork cut a nick through which the air can pass when the cork is pushed into the tube. Wash the cork thoroughly with warm water, and leave it to soak in water for some hours before use. Pass the zinc rod about 1 cm. through the cork.

Clean the glass tube and platinum wire carefully, then heat the exposed end of the platinum red hot, and insert it in the mercury in the test tube, taking care that the whole of the exposed platinum is covered.

Shake up the paste and introduce it without contact with the upper part of the walls of the test tube, filling the tube above the mercury to a depth of rather more than 2 cm.

Then insert the cork and zinc rod, passing the glass tube through the hole prepared for it. Push the cork gently down until its lower surface is nearly in contact with the liquid. The air will thus be nearly all expelled, and the cell should be left in this condition for at least 24 hours before sealing, which should be done as follows:—

Melt some marine glue until it is fluid enough to pour by its own weight, and pour it into the test tube above the cork, using sufficient to cover completely the zinc and soldering. The glass tube should project above the top of the marine glue.

The cell thus set up may be mounted in any desirable manner. It is convenient to arrange the mounting so that the cell may be immersed in a water bath up to the level of, say, the upper surface of the cork. Its temperature can then be determined more accurately than is possible when the cell is in air.

In using the cell sudden variations of temperature should as far as possible be avoided.

Notes.

The Zinc Sulphate Solution.—The object to be attained is the preparation of a neutral solution of pure zinc sulphate saturated with $ZnSO_4 . 7H_2O$.

At temperatures above 30° C. the zinc sulphate may crystalise out in another form; to avoid this 30° C. should be the upper limit of temperature. At this temperature

* *See* Notes.

water will dissolve about 1·9 times its weight of the crystals. If any of the crystals put in remain undissolved they will be removed by the filtration.

The amount of zinc oxide required depends on the acidity of the solution, but 2 per cent. will, in all cases which will arise in practice with reasonably good zinc sulphate, be ample. Another rule would be to add the zinc oxide gradually until the solution became slightly milky. The solution when put into the cell should not contain any free zinc oxide; if it does then, when mixed with the mercurous sulphate, zinc sulphate and mercurous oxide are formed; the latter may be deposited on the zinc and affect the electro-motive force of the cell. The difficulty is avoided by adding as described about 12 per cent. of mercurous sulphate before filtration; this is more than sufficient to combine with the whole of the zinc oxide originally put in, if it all remains free; the mercurous oxide formed together with any undissolved mercurous sulphate is removed by the filtration.

The Mercurous Sulphate.—The treatment of the mercurous sulphate has for its object the removal of any mercuric sulphate which is often present as an impurity.

Mercuric sulphate decomposes in the presence of water into an acid and a basic sulphate. The latter is a yellow substance—turpeth mineral—practically insoluble in water; its presence at any rate in moderate quantities has no effect on the cell. If, however, it is formed the acid sulphate is formed also. This is soluble in water and the acid produced affects the electro-motive force. The object of the washings is to dissolve and remove this acid sulphate, and for this purpose the three washings described in the Specification will in nearly all cases suffice. If, however, a great deal of the turpeth mineral is formed it shows that there is a great deal of the acid sulphate present, and it will then be wiser to obtain a fresh sample of mercurous sulphate rather than to try by repeated washings to get rid of all the acid.

The free mercury helps in the process of removing the acid, for the acid mercuric sulphate attacks it, forming mercurous sulphate and acid which is washed away.

The cell may be sealed in a more permanent manner by coating the marine glue, when it is set, with a solution of sodium silicate and leaving it to harden.

APPENDIX.

Dear Sir, August 12, 1892.

I am desired by the Electrical Standards Committee of the British Association to communicate to the Electrical Standards Committee of the Board of Trade the enclosed extract from their Report made to the Association on August 9th, 1892.

I remain,
Yours faithfully,
(Signed) R. T. Glazebrook,
Secretary, Electrical Standards Committee
of the British Association.

To Sir Thomas Blomefield,
Secretary, Electrical Standards Committee
of the Board of Trade.

Extract from the Report of the Electrical Standards Committee of the Association. August 9th, 1892.

The following resolutions were agreed to:—

1. That the resistance of a specified column of mercury be adopted as the practical unit of resistance.
2. That 14·4521 grammes of mercury in the form of a column of uniform cross section 106·3 cm. in length at 0° C. be the specified column.
3. That standards in mercury or solid metal having the same resistance as this column be made and deposited as standards of resistance for industrial purposes.
4. That such standards be periodically compared with each other, and also that their values be re-determined at intervals in terms of a freshly set-up column of mercury.

It was further agreed that these resolutions be communicated to the Electrical Standards Committee of the Board of Trade.

With regard to the units of current and electro-motive force it was agreed that the number ·001118 should be adopted as the number of grammes of silver deposited per second from a neutral solution of nitrate of silver by a current of one ampere and the value 1·434 as the electro-motive force in volts of a Clark cell at 15° C.

Dr. von Helmholtz expressed his full concurrence in these decisions, which are, as he informed the Committee, in accord with the recommendations which have already been laid by the Curatorium of the Reichsanstalt, as well as by himself before the German Government.

Final Report of the Electrical Standards Committee.

To the Right Honourable JAMES BRYCE, M.P., President of the Board of Trade.

Since the date of our last Report the Board of Trade have laid before us a *resumé* of the action of the International Electrical Congress held in Chicago in August 1893 to determine the units of electrical measurement. We were also informed by the Board of Trade that Her Majesty's Government had been invited by the United States Ambassador in London to take steps to adopt the recommendations of the Congress.

These recommendations, so far as they refer to the units of electrical resistance, electrical current, and electrical pressure, are substantially the same as those suggested for adoption in our previous reports.

We see no reason for further delay in the legalisation of standards of the above-mentioned units, and we have prepared and attach a revised Draft Order in Council which we advise may be submitted for Her Majesty's Gracious Approval.

The accompanying notes to the specification for the Clark's cell have been communicated by Mr. Glazebrook, and will be found of great assistance in the preparation of this form of cell.

(Signed) COURTENAY BOYLE.
KELVIN.
FRANCIS J. S. HOPWOOD.
P. CARDEW.
W. H. PREECE.
RAYLEIGH.
G. CAREY FOSTER.
R. T. GLAZEBROOK.
J. HOPKINSON.
W. E. AYRTON.

(Signed) T. W. P. Blomefield,
Secretary.

2nd August 1894.

Notes to the Specification on the Preparation of the Clark Cell.*

The Mercurous Sulphate.—The treatment of the mercurous sulphate has for its object the removal of any mercuric sulphate which is often present as an impurity.

Mercuric sulphate decomposes in the presence of water into an acid and a basic sulphate. The latter is a yellow substance—turpeth mineral—practically insoluble in water; its presence at any rate in moderate quantities has no effect on the cell. If, however, it is formed, the acid sulphate is formed also. This is soluble in water, and the acid produced affects the electro-motive force. The object of the washings is to dissolve and remove this acid sulphate, and for this purpose the three washings described in the specification will in nearly all cases suffice. If, however, a great deal of the turpeth mineral is formed it shows that there is a great deal of the acid sulphate present, and it will then be wiser to obtain a fresh sample of mercurous sulphate rather than to try by repeated washings to get rid of all the acid.

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* The specification will be found on page 12.

The free mercury helps in the process of removing the acid, for the acid mercuric sulphate attacks it, forming mercurous sulphate and acid which is washed away.

Pure mercurous sulphate when quite free from acid shows on repeated washing a faint primrose tinge which is due to the formation of a basic mercurous salt, and is distinct from the turpeth mineral or basic mercuric sulphate. The appearance of this primrose tint may be taken as an indication of the fact that all the acid has been removed and the washing may with advantage be continued until this primrose tint appears. Should large quantities of this basic mercurous salt be formed the sulphate should be treated as described in the instructions for setting up Clark's cells issued from the Physical Technical Institute of Berlin, *Zeitschrift für Instrumentenkunde*, 1893, Heft 5.

The Zinc Sulphate Solution.—The object to be attained is the preparation of a neutral solution of pure zinc sulphate saturated with $ZnSO_4 7H_2O$.

At temperatures above 30° C. the zinc sulphate may crystallise out in another form; to avoid this, 30° C. should be the upper limit of temperature. At this temperature water will dissolve about 1·9 times its weight of the crystals. If any of the crystals put in remain undissolved they will be removed by the filtration.

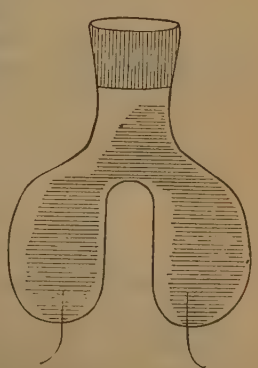
The zinc sulphate should be free from iron, and should be tested before use with sulphocyanide of potassium to ascertain that this condition is satisfied. If an appreciable amount of iron is present it should be removed by the method given in the directions already quoted, *Zeitschrift für Instrumentenkunde*, 1893, Heft 5.

The amount of zinc oxide required depends on the acidity of the solution, but 2 per cent. will, in all cases which will arise in practice with reasonably good zinc sulphate, be ample. Another rule would be to add the zinc oxide gradually until the solution became slightly milky. The solution when put into the cell should not contain any free zinc oxide; if it does, then, when mixed with the mercurous sulphate, zinc sulphate and mercurous oxide are formed; the latter may be deposited on the zinc and affect the electro-motive force of the cell. The difficulty is avoided by adding as described about 12 per cent. of mercurous sulphate before filtration; this is more than sufficient to combine with the whole of the zinc oxide originally put in, if it all remains free; the mercurous oxide formed together with any undissolved mercurous sulphate is removed by the filtration.

The Mercurous Sulphate and Zinc Sulphate Paste.—Although, after the last washing of the mercurous sulphate, as much water as possible may have been drained off, sufficient water generally remains to necessitate the addition of a *very considerable* quantity of crystals of zinc sulphate from the stock bottle, in order to insure saturation, when the washed mercurous sulphate is added to the zinc sulphate solution as described in No. 4 of Specification B appended to the Order in Council.

If the sides of the test tube above the cork be soiled by the introduction of the paste, the marine glue does not adhere to the glass; the liquid in the cell rises by capillary action between the glue and the glass and may damage the cell.

The form of the vessel containing the cell may be varied. In the H form devised by Lord Rayleigh and modified by Dr. Kahle the zinc is replaced by an amalgam of zinc and mercury. The other materials should be prepared as already described. Contact is made with the amalgam in one leg of the cell and with the mercury in the other by means of platinum wires sealed through the glass.



The amalgam consists of about 90 parts of pure mercury mixed with 10 parts of pure redistilled zinc. These are heated in a porcelain crucible to about 100° C., and gently stirred until the zinc is completely dissolved in the mercury. The amalgam is liquid while warm, and must be poured into the cell before it becomes solid on cooling.

The vessel containing the element consists of two vertical tubes. These, as shown in the figure, are closed below and open above into a common neck, which can be closed by a ground stopper of glass. The two tubes should be 2 cm. in diameter and 3 cm. in length. The neck should be at least 1·5 cm. in diameter and 2 cm. long. A short length of platinum wire is sealed through the bottom of each tube.

The end of the wire in one tube is covered by a small quantity of pure mercury, that in the other tube by the zinc-mercury amalgam.

Above the mercury a layer about 1 cm. thick of the mercurous sulphate paste is placed; above this, and also above the amalgam, a layer also about 1 cm. in thickness of zinc-sulphate crystals, and the vessel is filled up with the satured zinc sulphate solution.

The zinc-sulphate crystals are obtained by evaporating at a temperature of less than 30° C. some of the zinc-sulphate solution prepared as in 4 of the specification.

The stopper is then inserted, leaving a small air bubble above the liquid, and sealed on the outside with shellac dissolved in alcohol.

The ends of the platinum wires outside the cell form the two poles, and should be connected to suitable terminals.

AT THE COURT AT ,

The day of , 1894.

PRESENT,

THE QUEEN'S MOST EXCELLENT MAJESTY IN COUNCIL.

WHEREAS by "The Weights and Measures Act, 1889," it is among other things enacted that the Board of Trade shall from time to time cause such new denominations of standards for the measurement of electricity as appear to them to be required for use in trade to be made and duly verified.

And whereas it has been made to appear to the Board of Trade that new denominations of standards are required for use in trade based upon the following units of electrical measurement, viz. :—

1. The Ohm, which has the value 10^9 in terms of the centimetre and the second of time and is represented by the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice 14·4521 grammes in mass of a constant cross sectional area and of a length of 106·3 centimetres.

2. The ampere, which has the value $\frac{1}{10}$ in terms of the centimetre, the gramme and the second of time and which is represented by the unvarying electric current which when passed through a solution of nitrate of silver in water in accordance with the specification appended hereto and marked A deposits silver at the rate of 0·001118 of a gramme per second.

3. The Volt which has the value 10^8 in terms of the centimetre the gramme and the second of time being the electrical pressure that if steadily applied to a conductor whose resistance is one ohm will produce a current of one ampere, and which is represented by ·6974 $(\frac{1000}{1434})$ of the electrical pressure at a temperature of 15° C. between the poles of the voltaic cell known as Clark's cell set up in accordance with the specification appended hereto and marked B.

And whereas they have caused the said new denominations of standards to be made and duly verified.

Now, therefore, Her Majesty, by virtue of the power vested in Her by the said Act, by and with the advice of Her Privy Council, is pleased to approve the several denominations of standards set forth in the schedule hereto as new denominations of standards for electrical measurement.

SCHEDULE.

I.—STANDARD OF ELECTRICAL RESISTANCE.

A standard of electrical resistance denominated one Ohm being the resistance between the copper terminals of the instrument marked "Board of Trade Ohm Standard Verified 1894" to the passage of an unvarying electrical current when the coil of insulated wire forming part of the aforesaid instrument and connected to the aforesaid terminals is in all parts at a temperature of 15·4° C.

II.—STANDARD OF ELECTRICAL CURRENT.

A standard of electrical current denominated one ampere being the current which is passing in and through the coils of wire forming part of the instrument marked

"Board of Trade Ampere Standard Verified 1894" when on reversing the current in the fixed coils the change in the forces acting upon the suspended coil in its sighted position is exactly balanced by the force exerted by gravity in Westminster upon the iridio-platinum weight marked A and forming part of the said instrument.

III.—Standard of Electrical Pressure.

A standard of electrical pressue denominated one Volt being one hundredth part of the pressure which when applied between the terminals forming part of the instrument marked "Board of Trade Volt Standard Verified 1894," causes that rotation of the suspended portion of the instrument which is exactly measured by the coincidence of the sighting wire with the image of the fiducial mark A before and after application of the pressure and with that of the fiducial mark B during the application of the pressure, these images being produced by the suspended mirror and observed by means of the eyepiece.

In the use of the above standards the limits of accuracy attainable are as follows:—

For the Ohm, within one hundredth part of one per cent.

For the Ampere, within one tenth part of one per cent.

For the Volt, within one tenth part of one per cent.

The coils and instruments referred to in this schedule are deposited at the Board of Trade Standardising Laboratory, 8, Richmond Terrace, Whitehall, London.

SPECIFICATIONS referred to in the foregoing Order in Council.

Specification A.

In the following specification the term silver voltameter means the arrangement of apparatus by means of which an electric current is passed through a solution of nitrate of silver in water. The silver voltameter measures the total electrical quantity which has passed during the time of the experiment, and by noting this time the time average of the current, or if the current has been kept constant, the current itself, can be deduced.

In employing the silver voltameter to measure currents of about 1 ampere the following arrangements should be adopted. The kathode on which the silver is to be deposited should take the form of a platinum bowl not less than 10 centimetres in diameter, and from 4 to 5 centimetres in depth.

The anode should be a plate of pure silver some 30 square centimetres in area and 2 or 3 millimetres in thickness.

This is supported horizontally in the liquid near the top of the solution by a platinum wire passed through holes in the plate at opposite corners. To prevent the disintegrated silver which is formed on the anode from falling on to the kathode, the anode should be wrapped round with pure filter paper, secured at the back with sealing wax.

The liquid should consist of a neutral solution of pure silver nitrate, containing about 15 parts by weight of the nitrate to 85 parts of water.

The resistance of the voltameter changes somewhat as the current passes. To prevent these changes having too great an effect on the current some resistance besides that of the voltameter should be inserted in the circuit. The total metallic resistance of the circuit should not be less than 10 ohms.

Method of making a Measurement.

The platinum bowl is washed with nitric acid and distilled water, dried by heat, and then left to cool in a desiccator. When thoroughly dry it is weighed carefully.

It is nearly filled with the solution, and connected to the rest of the circuit by being placed on a clean copper support to which a binding screw is attached. This copper support must be insulated.

The anode is then immersed in the solution so as to be well covered by it and supported in that position; the connexions to the rest of the circuit are made.

Contact is made at the key, noting the time of contact. The current is allowed to pass for not less than half an hour, and the time at which contact is broken is observed. Care must be taken that the clock used is keeping correct time during this interval.

The solution is now removed from the bowl and the deposit is washed with distilled water and left to soak for at least six hours. It is then rinsed successively with distilled water and absolute alcohol and dried in a hot-air bath at a temperature of about 130° C. After cooling in a desiccator, it is weighed again. The gain in weight gives the silver deposited.

To find the current in amperes, this weight, expressed in grammes, must be divided by the number of seconds during which the current has been passed, and by 0·001118.

The result will be the time-average of the current, if during the interval the current has varied.

In determining by this method the constant of an instrument the current should be kept as nearly constant as possible, and the readings of the instrument observed at frequent intervals of time. These observations give a curve from which the reading corresponding to the mean current (time-average of the current), can be found. The current, as calculated by the voltameter, corresponds to this reading.

Specification B.

On the Preparation of the Clark Cell.

Definition of the Cell.

The cell consists of zinc or an amalgam of zinc with mercury and of mercury in a neutral saturated solution of zinc sulphate and mercurous sulphate in water, prepared with mercurous sulphate in excess.

Preparation of the Materials.

1. *The Mercury.*—To secure purity it should be first treated with acid in the usual manner, and subsequently distilled in vacuo.

2. *The Zinc.*—Take a portion of a rod of pure redistilled zinc, solder to one end a piece of copper wire, clean the whole with glass paper or a steel burnisher, carefully removing any loose pieces of the zinc. Just before making up the cell dip the zinc into dilute sulphuric acid, wash with distilled water, and dry with a clean cloth or filter paper.

3. *The Mercurous Sulphate.*—Take mercurous sulphate, purchased as pure, mix with it a small quantity of pure mercury, and wash the whole thoroughly with cold distilled water by agitation in a bottle; drain off the water, and repeat the process at least twice. After the last washing, drain off as much of the water as possible.

4. *The Zinc Sulphate Solution.*—Prepare a *neutral* saturated solution of pure ("pure re-crystalised") zinc sulphate by mixing in a flask distilled water with nearly twice its weight of crystals of pure zinc sulphate, and adding zinc oxide in the proportion of about 2 per cent. by weight of the zinc sulphate crystals to neutralise any free acid. The crystals should be dissolved with the aid of gentle heat, but the temperature to which the solution is raised should not exceed 30° C. Mercurous sulphate treated as described in 3 should be added in the proportion of about 12 per cent. by weight of the zinc sulphate crystals to neutralise any free zinc oxide remaining, and the solution filtered, while still warm, into a stock bottle. Crystals should form as it cools.

5. *The Mercurous Sulphate and Zinc Sulphate Paste.*—Mix the washed mercurous sulphate with the zinc sulphate solution, adding sufficient crystals of zinc sulphate from the stock bottle to ensure saturation, and a small quantity of pure mercury. Shake these up well together to form a paste of the consistence of cream. Heat the paste, but not above a temperature of 30° C. Keep the paste for an hour at this temperature, agitating it from time to time, then allow it to cool; continue to shake it occasionally while it is cooling. Crystals of zinc sulphate should then be distinctly visible, and should be distributed throughout the mass; if this is not the case add more crystals from the stock bottle, and repeat the whole process.

This method ensures the formation of a saturated solution of zinc and mercurous sulphates in water.

To set up the Cell.

The cell may conveniently be set up in a small test tube of about 2 centimetres diameter, and 4 or 5 centimetres deep. Place the mercury in the bottom of this tube, filling it to a depth of say ·5 centimetres. Cut a cork about ·5 centimetres thick to fit the tube; at one side of the cork bore a hole through which the zinc rod can pass tightly; at the other side bore another hole for the glass tube which covers the platinum wire; at the edge of the cork cut a nick through which the air can pass when the cork is pushed into the tube. Wash the cork thoroughly with warm water, and leave it to soak in water some hours before use. Pass the zinc rod about 1 centimetre through the cork.

Contact is made with the mercury by means of a platinum wire about No. 22 gauge. This is protected from contact with the other materials of the cell by being sealed into a glass tube. The ends of the wire project from the ends of the tube; one end forms the terminal, the other end and a portion of the glass tube dip into the mercury.

Clean the glass tube and platinum wire carefully, then heat the exposed end of the platinum red hot, and insert it in the mercury in the test tube, taking care that the whole of the exposed platinum is covered.

Shake up the paste and introduce it without contact with the upper part of the walls of the test tube, filling the tube above the mercury to a depth of rather more than 1 centimetre.

Then insert the cork and zinc rod, passing the glass tube through the hole prepared for it. Push the cork gently down until its lower surface is nearly in contact with the liquid. The air will thus be nearly all expelled, and the cell should be left in this condition for at least 24 hours before sealing, which should be done as follows.

Melt some marine glue until it is fluid enough to pour by its own weight, and pour it into the test-tube above the cork, using sufficient to cover completely the zinc and soldering. The glass tube containing the platinum wire should project some way above the top of the marine glue.

The cell may be sealed in a more permanent manner by coating the marine glue, when it is set, with a solution of sodium silicate, and leaving it to harden.

The cell thus set up may be mounted in any desirable manner. It is convenient to arrange the mounting so that the cell may be immersed in a water bath up to the level of, say, the upper surface of the cork. Its temperature can then be determined more accurately than is possible when the cell is in air.

In using the cell sudden variations of temperature should as far as possible be avoided.

The form of the vessel containing the cell may be varied. In the H form, the zinc is replaced by an amalgam of 10 parts by weight of zinc to 90 of mercury. The other materials should be prepared as already described. Contact is made with the amalgam in one leg of the cell, and with the mercury in the other, by means of platinum wires sealed through the glass.

Note.—An Order in Council in the above form was made by Her Majesty on the 23rd August, 1894.

NATIONAL PORTRAIT GALLERY.

THIRTY-SEVENTH ANNUAL REPORT

OF THE

TRUSTEES OF THE NATIONAL PORTRAIT GALLERY.

1894.

Presented to both Houses of Parliament by Command of Her Majesty.

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1894.

[C.—7520.] *Price* 1½*d.*

THIRTY-SEVENTH ANNUAL REPORT

OF THE

TRUSTEES OF THE NATIONAL PORTRAIT GALLERY.

1894.

TO THE LORDS COMMISSIONERS OF HER MAJESTY'S TREASURY.

The Trustees of the National Portrait Gallery have the honour to submit herewith their Thirty-seventh Annual Report to the Lords Commissioners of Her Majesty's Treasury.

The Trustees desire to record their deep sorrow at the sudden death of their Colleague the Right Honourable Edward Stanhope, M.P., whose loss they greatly deplore, and to express their full appreciation of his never-failing courtesy, of his clear judgment and extensive knowlege which on all occasions he was able and willing to impart.

The names of the Trustees who at present constitute the Board are as follows:—

The Viscount Hardinge (Chairman).
The Lord De L'Isle and Dudley (Vice-Chairman).
The Lord President of the Council (for the time being).
The Earl of Pembroke.
The Lord Ronald Gower.
The Lord Edmond Fitzmaurice.
The Viscount Cobham.
The Viscount Dillon, V.P.S.A.
The Right Hon. the Speaker.
The Right Hon. Wm. Ewart Gladstone, M.P.
Sir Coutts Lindsay, Bart.
The President of the Royal Academy of Arts (for the time being).
Sir John Everett Millais, Bart., R.A.
Sir Charles Tennant, Bart.
W. H. Alexander, Esq.
Henry Hucks Gibbs, Esq.

The Lords Commissioners of Her Majesty's Treasury were pleased by letter, dated April 20th, 1894 (No. 5434), to nominate Lord De L'Isle and Dudley Vice-Chairman of the Board of Trustees.

Since the date of their last Report, 9th June 1893, this meeting inclusive, the number of meetings held by the Trustees is three; and from the 9th February 1857, when the Trustees commenced their duties, 206.

The list of 527 donations, as given in their former Reports, may now be continued as follows:—

528. Alfred Lord Tennyson, D.C.L., F.R.S., 1809—1892.
Poet Laureate.

A marble bust, copied by Miss Grant from the original sculptured from life in 1857, *by T. Woolner, R.A.*

Description.—The head is slightly turned to his right shoulder. He wears a close-buttoned coat with a cravat and shirt collar turned down over it. The upper part of the neck is exposed. The face is close shaven. His luxuriant flowing hair conceals the ears. The eyebrows are bushy. The eyeballs not indicated.

Inscribed on the side of the pedestal "Copied by Miss Grant, 1893" and in front "TENNYSON."

Presented by his son Hallam Lord Tennyson, November 1893, for whom the copy was made. Register Number 947.

529. EDWARD HENRY LORD STANLEY, M.P., afterwards 15th EARL OF DERBY, K.G., 1826—1893.

Drawn in chalk by Samuel Laurence.

Educated at Rugby and Cambridge. M.P. for King's Lynn, 1848. Under Secretary of State for Foreign Department, 1852. Secretary of State for India, 1858, when, under his auspices, the Government of India was transferred from the East India Company to the Crown. Appointed a Trustee of the National Portrait Gallery, August 1861, in the room of Sir Francis Palgrave. Secretary of State for the Foreign Department, 1866, and again in 1874. He succeeded as Earl of Derby, 1869.

Description.—A bust portrait in black chalk on paper. The head, the size of life, seen in three-quarters to the right. The eyes, with a piercing expression, looking slightly to the right (not at the spectator). Wearing an ordinary coat and waistcoat, a black neck-tie fastened in a bow, white shirt collar standing, front of shirt quite plain. The face is close shaven, lower lip full; chin round and double, slightly cloven. The eyebrows faint. The hair thin and wavy. No whiskers. Background, flat grey tint. Light from left hand. Shadows deep and well massed.

Presented, November 1893, by his widow, Mary Countess of Derby. Register Number 948.

530. JOHN DEAN.

Painted by Willem Verelst.

The only survivor among 16 sailors who gallantly remained on board a vessel belonging to the Honourable East India Company's service when deserted by the rest of the crew.

In March 1738 the ship "Sussex," homeward bound from Canton, sustained such severe damage by storms off the Cape of Good Hope, that the captain, officers, and the greater part of the crew resolved to abandon her. Sixteen men, however, including John Dean, refused to desert the vessel, insisting that she was still seaworthy. These brave men alone carried her to Madagascar, where they did their best to refit her, and made sail for Mozambique; but on the way the ship struck on a shoal and went to pieces. Five of the men escaped in the pinnace and regained Madagascar after a 17 days' voyage; but sickness fell upon them, and when an opportunity of returning to Christendom came, John Dean was the only survivor. He was first conveyed to Bombay, and did not reach London till two years later. The captain and officers of the "Sussex" were punished for the abandonment of the vessel, and a pension of 100*l.* a year was settled upon Dean. The Court caused "two original portraits to be painted of him to keep alive the memory "of the bravery and devotion shown by these men in remaining at their posts in the face "of every discouragement." One of these originals was presented to Dean himself, and the other, with a copy, was hung on the walls of the old India House. The latter is now transferred to this Gallery.

Description.—A life-sized figure, more than half length, standing to the left, bare headed, holding a directed letter down in his right hand, and a thick stick (or cudgel) in his left. His swarthy close-shaved face is seen in three-quarters to the left. His dark brown eyes fixed on the spectator. His close cropped hair is very dark brown, and the eyebrows dark brown and bushy. The lips a dull red and glossy. He wears a yellow grey coat and leggings. The sleeves are open to show a white shirt cross-barred with blue. Round his neck a dark red-brown wrapper. A black hat under his left arm. Background, plain and dark brown. Painted in period of Kneller. Light admitted from left hand, and the side of his nose is in shadow. Dark brown toned picture. Canvas. Inscription on letter.

On loan from the India Office, November 1893. Register Number 949.

531. SIR CHARLES LOCKE EASTLAKE, P.R.A., 1793—1865.

A marble bust by John Gibson, R.A.

Born at Plymouth. Educated at Charterhouse. Entered as a student at the Royal Academy, and attended Sir Charles Bell's lectures on anatomy. Travelled in Greece and established himself at Rome during a period of nearly 12 years. His pictures of "Pilgrims arriving in sight of Rome" and "Byron's Dream" secured him immediate popularity. He chiefly devoted himself to scenes from Italian history. In 1841, under the auspices of the Prince Consort, he was appointed Secretary to the Royal Commission for decorating the "Houses of Parliament." In 1843 he became Keeper of the National Gallery, and was subsequently appointed Director in 1855. In 1850 he was chosen President of the Royal Academy. His later years were principally devoted to the Literature of the Fine Arts. He travelled much in Italy, and was the means of securing many pictures of importance in

the history of Art for the National Gallery. He died at Pisa, December 1865, and was buried in the Kensal Green Cemetery. Sir Charles Eastlake was one of the original Trustees of the National Portrait Gallery in 1856.

Description.—Marble bust. Head turned straight forward. No drapery, bare neck. Rather bald head, short whiskers not descending below the ear, rest of face close shaven. Eyebrows arched and full. Eyeballs not indicated. Inscribed on side of terminal—

I. GIBSON FECIT,
ROMÆ.

Plain in front.

Bequeathed, March 1894, by his widow the late Lady Eastlake. Register Number 953.

532. MRS. GRAHAM afterwards LADY CALLCOTT, 1785—1842.

Painted by Sir Thomas Lawrence, P.R.A. (unfinished portrait).

Maria, daughter of Admiral Dundas, a Commissioner of the Admiralty. Born near Cockermouth. In 1808 she sailed with her father for India, where she married Captain Thomas Graham, R.N. They explored India, and travelled in Italy and South America. Captain Graham died off Cape Horn in 1822. His widow on returning to England devoted herself to literature, in which she achieved success. In 1827 she married Augustus Wall Callcott, a distinguished painter, and with him revisited Italy, making excursions from Rome, then a centre of the most cultivated society. They published an illustrated description of Giotto's paintings in the Arena Chapel at Padua, and essays towards the history of painting. A Scripture Herbal was her last work, but she is more extensively remembered by her "Little Arthur's History of England." Her husband received the honour of knighthood on the Accession of Queen Victoria in 1837. She died at his residence at Kensington.

Painted at Rome by Sir Thomas Lawrence. "The work of two hours, during the "whole of which time Sir Charles Eastlake was present."

Description.—Head and neck the size of life. Wearing a plain white turban after the fashion of Guido's Beatrice Cenci. The face is seen in three-quarters turned to the left. Her dark flashing brown eyes look slightly up to the left. Her hair is black and glossy. Eyebrows black and grey, soft and flowing. Lips rich red and slightly showing teeth. Neck bare, part of white head-dress falls beside her neck on the left side. Background flat, warm grey. Indication of white dress, but the canvas below is left quite bare. In gilt frame with oval spandril and glass.

Bequeathed, March 1894, by Lady Eastlake. Register Number 954.

533. RIGHT HON. PHILIP HENRY, 5TH EARL STANHOPE, D.C.L., F.R.S., P.S.A., 1805—1875.

Medallion, in plaster, by Frederick Thomas.

Founder of the National Portrait Gallery.

Having carried an address in the House of Lords, 4th March 1856, for the establishment of the National Portrait Gallery, he was at once appointed Chairman of the Board of Trustees, and held that office till his death.

Description.—Modelled in alto-relief within a deep circular border. The figure seen to the waist is turned nearly full. The face slightly turned to the right. He wears a furred cloak over an ordinary coat and waistcoat, a cravat and collar. The face is shaven, excepting a short whisker, not reaching below the ear. His right hand is seen holding an eyeglass. The hair full at the sides and over centre of forehead. Brows slightly contracted.

A model in plaster, on a reduced scale, of the medallion placed over the entrance doorway to the New National Portrait Gallery Building, by Frederick Thomas, by whom the larger medallion was also executed.

Presented, 19th March 1894, by George Scharf, Esq., C.B., F.S A. Register Number 955.

534. HENRY HUNT, 1773—1835.

Painted by Adam Buck.

A noted mob orator of the radical school. Began life as a prosperous farmer at Uphaven in Wiltshire. He was then a staunch loyalist and received the thanks of the Lord Lieutenant of the county for proffer of his services in 1801 when the kingdom was menaced with invasion. He joined the Marlborough troop of cavalry, but being guilty of insubordination, was indicted in the Court of King's Bench, found guilty, fined 100*l.*, and imprisoned for six weeks.

From this time he became a radical reformer. He was accepted as the fearless champion of his party.

He long strove for a seat in Parliament and was at last elected for Preston, 1830—1831.

He presided at a meeting at Manchester, July 1819, which ended in loss of life and limb to many of his hearers, when he was indicted as the ringleader of an unlawful assembly. He was sentenced to three years' imprisonment in Ilchester Gaol. He died of paralysis.

Description.—A small half length profile figure in a black coat and white trousers. White cravat and shirt frill. Standing to the left with arms folded and tips of fingers of his right hand seen. His close shaven ruddy face is turned completely in profile to the left. Eyes small blue grey. His hair is thick and solid of a mellow grey colour. The background is plain, grey and blue clouds. Light from right hand.

In water colours upon white paper.

Presented, 19th March 1894, by H. Willett, Esq. Register Number 956.

535. Another Portrait.

Painted by Adam Buck.

Description.—Small figure, full length, seated in an armchair to the left, wearing a black coat, knee breeches, and silk stockings. Ties instead of buckles to shoes. White waistcoat and cravat. His left knee is crossed over the right and he holds a paper in his lap with both hands. The pale, close shaven face is seen in three-quarters to the left, the small grey eyes looking at the spectator. Hair mellow grey. A dull red folding screen behind him. A table in two portions to the left with book, inkstand, and open paper on it. The floor is covered with a patterned carpet. Light from right-hand side. On paper on his knee is inscribed—

"Report Committee, Ilchester Gaol."

On the table,

"Act of Parliament,

"Roasted corn,

"Henry Hunt."

Presented, 19th March 1894, by H. Willett, Esq. Register Number 957.

536. William Roscoe, M.P., 1753—1831.

Painted probably by John Williamson.

A self-taught historian and writer on art. Born of humble parents near Liverpool, and began life as a market gardener. He was then placed with a bookseller, but soon after apprenticed to an attorney in Liverpool, where he attained considerable practice in the law. A poem which he wrote on the origin of engraving made him known to Sir Joshua Reynolds and Fuseli. He was elected Honorary Member of the Manchester Literary and Philosophical Society in 1784. He wrote against the Slave Trade, and favoured the French Revolution.

In 1796 he published his life of Lorenzo de' Medici. In 1805 he completed his volumes on Leo X. In 1806 he was elected M.P. for Liverpool. Roscoe published numerous pamphlets and essays, and in 1824 edited the works of Pope.

He founded the Royal Institution at Liverpool, and greatly encouraged a taste for Italian literature and the Fine Arts, especially in his native city.

Description.—Reading a pamphlet held up in his right hand. A life-sized portrait seen to the elbow. Wearing a black coat and white ruffles. His white cravat is tied in a loose bow. Within the collar of his dark coat appears the edge of a pale blue waistcoat. His close shaven face, with clear complexion and pink cheeks, is seen in three-quarters turned to the right. His indigo blue grey eyes are cast slightly down. His hair, dark rich brown, is brushed away from his forehead. Eyebrows bushy and pale brown. The black bow of a tie appears behind. The red back of his chair is seen to the left. Light is admitted from the left-hand side. Background, plain dark brown. The motive of the attitude appears to have been derived from Reynolds' portrait of Dr. Johnson reading. Painted probably by John Williamson, of Liverpool.

Presented, June 1894, by Sir Henry Roscoe, M.P., F.R.S.

Register Number 963.

537. William of Nassau, Prince of Orange, 1627—1650

Painted in the school of Van Dyck.

Father of William III., King of Great Britain and Ireland. Only son of Henry Frederick, Prince of Orange, Commander-in-Chief of all the Forces of the States-General both by land and sea. Married in 1642, at the age of 15, to Princess Mary, eldest daughter of Charles I., then in her eleventh year. He succeeded his father in May 1647 as William II., Prince of Orange, and in military command over the States. He died of smallpox at the Hague in the 24th year of his age.

Description.—Bust portrait, life size, of a boy in rich costume with long flowing hair parted over the forehead, wearing a white collar edged with lace, falling to his shoulders, fitted close to the cheek and tied under the chin by a white cord with small tassels. A satin cloak covers his left arm. The front of his dress is slashed and puffed with white. The face is seen in three-quarters to the left, his eyes looking at the spectator. The side of the nose is in shadow. Background, plain dark brown.

Presented, June 1894, by Viscount Cobham.

Register Number 964.

In the previous Report the purchases were stated to amount to 479. They may now be continued, as the following list will show, to 487 :—

480. Frederick, King of Bohemia, K.G., 1596—1632.

Painted by Mireveldt.

The Calvinist son-in-law of James I., and grandfather of King George I. He was grandson of William the Silent, Prince of Orange, Count Palatine of the Rhine, Duke of Bavaria and Elector Palatine and cup-bearer to the Empire. In 1613 he married the Princess Elizabeth, the only daughter of King James I. of England, and was elected King of Bohemia 1619 in opposition to the Emperor Ferdinand, but driven out of his dominions and deposed from his Electoral Dignity in 1623. After 10 years' exile, he died at Mentz. His wife, known as the Queen of Hearts, survived him till 1662. Among their numerous children were Prince Rupert, Prince Maurice, and Sophia Electress of Hanover, mother of George I., who succeeded Queen Anne on the Throne of England.

Description.—Small portrait on panel, seen to the waist, wearing a falling ruff of white lace fitting close to cheek and chin, a black dress embroidered with gold, and slashed to show white shirt underneath. The face is turned in three-quarters to the right, and the dark slaty-grey eyeballs looking at the spectator. His very dark brown flowing hair hangs down behind his ears. Eyebrows pale soft brown. The cheeks close shaven, but his pointed chin, beard, and moustaches are pale light yellow brown. No ear-ring. A small tassel to his ruff, hangs by a fine white cord. A similar picture, formerly at Hampton Court Palace, is now at Holyrood.

Purchased by the Trustees, November 1893, for 20*l.* Register Number 950.

481. Sir Peter Lely, 1617—1680.

Painted by himself.

The chief painter of the Reign of Charles II. The name of his father, a captain of infantry, was Vander Faes. He was born at Soest in Westphalia, and studied under Grebber at Haerlem. He came to England in 1643, and the King sat to him. Among his best portraits is one of Oliver Cromwell. During the reign of Charles II. he painted all the beauties of the Court. He died suddenly whilst painting the Duchess of Somerset, and was buried in Covent Garden Church. The bust on his monument was carved by Gibbons, and his epitaph written by Flatman.

Description.—Head only, life size on canvas fastened to panel. A very dark picture. The face is turned in three-quarters to the right; the dark brown eyes looking at the spectator. His full dark brown hair covers the forehead, and conceals the ears. Eyebrows broad and very dark. Face quite smooth, excepting a narrow strip of moustache at the corners of the mouth. Lips deep crimson and full. A deep cleft between nose and upper lip. Dress all dark, excepting one small piece of neck-tie of deep bluish grey. Light from left-hand side. Background, dark plain brown. Coarsely painted.

Purchased by the Trustees, November 1893, for 4*l.* Register Number 951.

482. Elizabeth Claypole, 1629—1658.

Painted on panel by Joseph Michael Wright.

Second and favourite daughter of Oliver Cromwell. Married about 1645 to John Claypole, of Norborough, who was appointed Master of the Horse and Lord of the Bedchamber to Cromwell, and took a leading part in public ceremonials, especially at the solemn investiture of his father-in-law as Protector. He was also placed by Cromwell in his upper house. Mrs. Claypole was much elated by her father's sovereignty, but Harrington states that she "acted the part of Princess very naturally, obliging all persons by her civility, and frequently interceding for the unhappy." She was a loyalist and a member of the Church of England.

Her father was deeply affected by her death. It is said that she upbraided him in her last moments with the blood he had shed. Carlyle states that Cromwell remained at Hampton Court 14 days by his daughter's bedside unable to attend to any public business whatever.

Her funeral was performed with great pomp in Westminster Abbey.

The allegorical accessories in her various portraits imply that she was a votary of science.

Description.—A small-sized figure, seen to below the knees, standing slightly towards the right, resting her right arm on a mass of rock with sculpture on the side. She wears a white metal breastplate faced with gold. Round her shoulders and fastened in front passes a white mantle lined with blue on one end of which her arm rests. Her right hand gathers up the ample folds of a rich crimson skirt. Her left hand holds a small locket and chain with a cameo bearing a profile of Oliver Cromwell. Her face is seen in three-quarters to the right, the large dark grey eyes looking towards spectator. Her dark brown hair is parted in the middle with long curls hanging down beside the ears. Two large long pearls are appended to each ear. The neck is much uncovered, with only a single row of pearls round it. Jewels and pearls decorate the back of her hair. Eyebrows pale and soft. Lips clear pale red. To the left are the trunks of laurel trees. On the stone beside her elbow is placed a silver

model of a turreted castle encircled with a wreath of cypress. The background to the right of figure is composed of storm clouds partly obscuring the sun and an expanse of sea with high horizon covered with ships and a fleet against the horizon. Lower down a crew embarking. The sculpture on the rock is an alto-relief naked figure of Jupiter with thunderbolt in his right hand and an eagle at his feet. A small figure of Minerva fully armed, helmet, spear, and shield issues from his head and flies to earth. Beneath on a straight label is written

AB JOVE PRINCIPIUM

signed in the right-hand lower corner in black letters on brown.

I: MRitus P
J658

On the back of the oak panel is an old paper with writing in ink.

"Elizabeth, second Daughter of Oliver Cromwell, wife to John Cleypole (*sic*) Esqre."

Purchased by the Trustees, November 1893, for 52*l.* 10*s.* Register Number 952.

483. JOHN MARTIN, K.L., 1789—1854.

Painted by Henry Warren, K.L.

Imaginative and original painter of sacred subjects.

Born near Hexham. He began life as an heraldic coach painter, and made his way to London in 1806. He married early, and supported himself by painting on china and glass. This kind of manipulation was frequently traceable in his after works, and he never overcame a taste for oriental glitter. He studied architecture and perspective with extreme care. His picture, in 1816, of "Joshua commanding the sun to stand still," brought him prominently into notice, and his works became highly popular, especially "The fall of Babylon" and "Belshazzar's Feast." For the latter, in 1821, he was awarded a premium of 200*l.*

For his book illustrations to "Paradise Lost" during the years 1832—38 he received 2,000*l.*

He quarrelled early with the Royal Academy. When the Society of British Artists was founded he joined them with ardour, but his contributions soon fell off, and he never ceased to send to the Academy. He also devoted much time to schemes for improvement of the metropolis, both in architecture and drainage. He was seized with paralysis whilst in the act of painting, and died at Douglas in the Isle of Man.

It has been remarked that "no painter has ever like Martin represented the immensity "of space, none like him made architecture so sublime, merely through its vastness; no "painter like him has spread forth the boundless valley or piled mountain upon mountain "to the sky, like him, none has made light pour down in dazzling floods from heaven, and "none has like him painted the darkness visible of the infernal deeps.

Description.—Painted on mahogany. A small half-length figure seen across a table in black suit, white cravat, collar, and shirt frill, turned to the right, resting his right arm on the table and a tablet or drawing. A brush in his right hand and a round palette set with colours on his left arm. The face is turned in three-quarters to the right. His small grey eyes looking towards the spectator. Complexion ruddy, lips pale clear red. Short reddish whiskers close to the ear. His hair is yellow brown, shiny and curly. The eyebrows are broad and yellow brown. The background is a hazy grey representation of a conflagration, perhaps Nineveh.

Purchased by the Trustees, June 1894, for 5*l.* 5*s.* Register Number 958.

484. GEORGE ROMNEY, 1734—1802.

An unfinished picture painted by himself.

Born at Dalton in Lancashire. Assisted his father as a cabinet maker till his 21st year, when he was articled for four years to an itinerant portrait painter then practising at Kendal.

Before the expiration of that period his indentures were cancelled. He never had any regular training for art. He selected his own models and, through life, never sought academic honours. Romney arrived in London, 1762, and exhibited some historical compositions, which gained him prizes at the Society of Arts. After a brief visit to France in 1764, he attended the drawing school of the Incorporated Society of Artists.

In March 1773 he went with Ozias Humphry to Italy, and studied especially at Rome, Venice, and Parma. On his return to London in 1775, Romney established himself in a large house in Cavendish Square. He now seemed to divide the favour of the town with Sir Joshua Reynolds.

Lord Thurlow said "there were two factions, the Reynolds faction and the Romney faction; I was of the Romney faction."

He still adhered to historical composition, and assisted Alderman Boydell in forming "The Shakspeare Gallery" at Pall Mall.

After an uninterrupted career of employment for more than 20 years, he removed to Hampstead, when his infirmities increasing, he returned to his native district and died at Kendal, November 1802.

Description.—The figure is seen sideways, seated towards the right leaning against the tall back of his chair. Unfinished painting. The head, which alone is finished, is turned in three-quarters to the right, the dark brown eyes looking fixedly at the spectator. The face is close shaven. He wears his own natural brown hair. The eyebrows are dark and raised. The lips are pale red. Light admitted from the left-hand side, his left cheek being in deep shadow. The rest of the figure indicated by broad and bold strokes of the brush, shows the arms folded, no hands visible. He wears a loose coat of a reddish brown colour. The legs scarcely indicated were probably intended to be crossed. Dark brown background round the head. Nearly one-half of the grey-toned canvas is left bare.

This picture was begun December 1782, when he was 48 years of age.

It was given by Mr. Romney to Mr. Hayley, "who did not allow him to finish it, but hurried it off to Eartham without delay. The head, however, is perfect."

Purchased, May 24th 1894, at the sale of Miss Romney's effects by Messrs. Christie, for 44*l.*

Engraved by Thomas Wright as a frontispiece for the Rev. John Romney's life of his father, 4to., 1830.

In 1862 the picture was first exhibited by the Rev. John Romney at the British Institution, Pall Mall, and again at the Loan Exhibition of 1867 at South Kensington.

Register Number 959.

485. Thomas Lord Erskine, K.T., 1750—1823.

Painted by Sir William Ross, R.A.

Lord Chancellor in the "Coalition Ministry of All the Talents," 1806, under Grenville.

A younger son of the tenth Earl of Buchan, educated at Edinburgh and Aberdeen, entered the navy as midshipman and after four years joined the army.

He remained eight years and then entered himself at Lincoln's Inn and studied at Cambridge. At the bar he excelled in defending political cases. He defended Stockdale, Lord George Gordon, Admiral Keppel, Paine and Horne Tooke. Became Attorney-General to the Prince of Wales.

King's Counsel, 1783; M.P. for Portsmouth.

Description.—Life sized portrait to the waist. The pale close shaven face is turned in three-quarters to the right. His dark brown curly hair (a wig) is in solid masses. Eyes very dark, looking at spectator. He wears a white cravat tied in a bow and rising shirt collar (temp. George IV.). Dark brown plain buttoned coat. The Star of the Thistle is on his left brest. Background, plain dark brown.

Purchased by the Trustees, June 1894, for 63*l.* Register Number 960.

486. William first Lord Paget, K.G., 1506—1563.

Painter unknown.

Born in London 1506. His father was mace sergeant to the Corporation. Diplomatist. Employed by Gardiner Secretary of State. Executor of Henry VIII. In favour with Queen Mary. Charles V. declared that Sir William Paget deserved to be a King as well as to represent one.

Description.—A square panel. A half length portrait nearly in full slightly to left. Wearing a reddish yellow beard divided into two masses (forked). Small dark eyes turned on spectator. Light is admitted from the left and side of nose in shadow. A plain black cap straight across the forehead. His left bare hand holds a small white scroll or wand. White ruffles at wrist. His right hand grasps the yellow fur facing down the front of his robe. A small circular St. George and the Dragon hangs in front by a long thin chain. No gilding. A large jewelled ring on the thumb of his left hand. Background, plain dark brown.

Purchased by the Trustees, June 1894, for 40*l.* Register Number 961.

487. Sir Henry Spelman, 1562—1641.

Painted by Paul van Somer.

An eminent Antiquary born at Congham in Norfolk. Educated at Trinity College, Cambridge, and at Lincoln's Inn. In 1604, he served the office of high sheriff of Norfolk. Went to Ireland as one of the Commissioners for settling the titles of land in that country. He was appointed a Commissioner to inquire into the exaction of fees in the Courts and Offices of England, for which he received the honour of knighthood. His great work was his "Glossarium Archaiologicum," begun in folio 1626.

He was a fellow of the original Society of Antiquaries, and became the intimate friend of Camden, Cotton, and Speed. Spelman devoted himself to the Antiquities of English law as deducible from original records. He also wrote a "History of Sacrilege," which was destroyed in the Fire of London.

He was buried in Westminster Abbey "with much solemnity" by order of Charles I.

Description.—A bust portrait the size of life, wearing a tall yellow skull cap, bordered with white bone lace, a black dress and a radiating ruff, edged with lace. The face is seen in three-quarters turned to the left, light admitted from the left-hand side. The grey eyes look towards the spectator. The iron-grey beard is square and solid, and the mouth

concealed by the moustaches. The lobe of his left ear is visible. The face is ruddy. No ties or fastenings visible. Background, plain dark brown. Painted on canvas.
Purchased by the Trustees, June 1894, for 12*l.* 12*s.* Register Number 962.

The following six pictures have been cleaned and lined :—

Lord Aberdeen.
Archbishop Bancroft.
Alderman Phillips.
Sir R. Owen.
Lady Callcott.
Mrs. Claypole.

The following six pictures have been put under glass :—

King of Bohemia.
Earl of Derby.
Earl Stanhope.
Archbishop Bancroft.
Lady Callcott.
Mrs. Claypole.

The following 17 portraits have been copied in oils :—

Thomas Campbell.
Robert Burns.
George IV.
Duke of Wellington.
Catherine Stevens, Countess of Essex.
Nelson.
Sir Thomas Lawrence.
Dr. Watts.
De Quincey.
Mary Davis.
Countess of Grammont.
Sarah Siddons.
Sir William Temple.
Sir James Mackintosh.
Sir Walter Scott.
Oliver Cromwell.
James, 2nd Duke of Ormonde.

The following 21 pictures and busts have been photographed :—

Captain Dampier.
Mrs. E. B. Browning.
John Keats (twice).
W. S. Landor.
Wesley.
Lord Bacon.
Shakspeare.
Milton.
Newton.
Sir Walter Scott.
Roubiliac.
Hogarth.
John Allen.
First Earl of Chatham.
Horace Walpole.
Marquis of Rockingham.
Queen Charlotte.
C. J. Fox.
Lord North.
John Wilkes.
Robert Burns.

ESTABLISHMENT :

The permanent clerk, Mr. L. G. Holland, died on 15th August 1893. Mr. J. D. Milner, a clerk of the Second Division of the Civil Service, has been appointed to fill the vacancy, in a temporary capacity, until the Gallery is removed into the new building when the matter is to be again brought before the Treasury. *See* Treasury letters. No. 12,680 of 17th August 1893 and No. 17,347 of 8th December 1893.

The housekeeper and resident caretaker of the offices in Great George Street died on 3rd October 1893. It has been decided not to fill up this post, but to appoint in lieu a non-resident watchman and charwomen, whose pay is to be borne on the Vote for the National Portrait Gallery. The Treasury authorised the provision in the Estimates for the current year of a sum of 152*l.* per annum for this purpose. *See* Treasury letter, No. 17,260, 30th November 1893. The change of service commenced 31st March 1894.

PROGRESS OF THE BUILDING.

In their last Report, dated 9th June 1893, the Trustees expressed a hope that the New Gallery, or some portion of it, would be in working order by the following spring.

These expectations, however, have not been realised.

In explanation of this delay, a letter was addressed to her Majesty's Office of Works by Mr. Ewan Christian, the architect, dated 16th March 1894, and from this letter, with the approval of the Board of Works, the following notes have been taken :—

After a recent consultation with Mr. Shillitoe, March 1894, Mr. Ewan Christian came to a conclusion that the whole of the main building could be properly finished in about nine months from the present time, and if required for preliminary use the South-

east Gallery could be finished and handed over in one month from the same time; but if these rooms are not really wanted for use it would be preferable to wait a little longer still.

Mr. Christian had in a former Report expressed his belief that the North Building could be finished by the end of August next, but the sudden and unexpected death of a principal assistant rendered a fresh calculation necessary. He now states :—

"This has caused some delay in the preparation of work which cannot be safely hurried, and it is on this account that more time is needed."

Mr. Christian adds :—

"The work in the interior of the building has been progressing as fast as I think "desirable; the windows have been purposely kept open during the whole winter "with excellent results. With the exception of the principal staircase, which is not "yet sufficiently dry, the plastering has been carried on in all stories, and is now far "advanced towards completion. All the boarding for the walls is in the galleries "ready for fixing as soon as required, and the heating works are far advanced.

"I think, therefore, the time now named may be safely taken as conclusive."

Although the Director has already devoted much of his time to considering the disposition and arrangement of the portraits on the new walls, and his plans are in a great measure matured, a considerable time must of necessity elapse between the reception of the portraits from Bethnal Green and other places of temporary deposit, and the thorough completion of the Gallery for admission of the public.

The number of visitors to the Gallery from the commencement in Great George Street, Westminster, to September 1885 (when the pictures were removed to Bethnal Green), is shown in the following table :—

Year.	Visitors.	Year.	Visitors.
1859	5,305	1876 (Exhibition of Scientific Instruments, and the Prince of Wales's Indian Presents).	108,252
1860	6,392	1877	79,987
1861	10,907	1878	72,105
1862 (Exhibition year)	17,927	1879 (closed for alterations in the spring months).	64,034
1863	10,475	1880	76,109
1864	14,885	1881	84,532
1865	16,642	1882	84,599
1866	24,666	1883 (International Fisheries Exhibition).	146,187
1867	24,649	1884 (International Health Exhibition).	120,716
1868	25,344	1885 (International Inventions Exhibition). Closed in September for removal.	88,760
1869 (not opened at Christmas)	24,757		
1870 (opened in March at South Kensington).	58,913		
1871	63,195		
1872	67,039		
1873	60,047		
1874	65,201		
1875	71,740		

Grand Total, September 1885, at South Kensington - - - 1,493,365

The following table shows the number of visitors in each month for the last 10 years till the removal from South Kensington :—

Months.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.
January -	4,948	4,401	4,418	2,880	4,435	4,332	6,006	7,168	6,160	5,824
February -	3,687	3,588	3,023	71	3,222	3,135	3,655	4,292	5,054	4,966
March -	4,937	4,785	4,753	—	10,784	5,101	4,936	12,068	6,349	6,446
April -	14,375	10,430	10,138	—	5,984	10,946	9,725	7,679	13,233	11,061
May - -	7,280	11,204	4,592	533	10,326	5,558	8,950	19,731	8,280	12,763
June -	14,976	5,065	9,419	15,425	5,759	10,537	5,928	11,402	12,973	9,710
July -	12,491	8,399	6,341	9,122	6,715	5,521	7,885	14,079	11,832	12,811
August -	17,322	9,938	10,316	12,200	10,978	14,957	13,716	26,074	18,405	25,179
September -	14,015	7,756	7,075	9,051	5,746	7,934	8,914	15,843	15,125	—
October -	5,907	4,888	4,445	5,827	3,936	5,013	5,386	17,616	11,310	—
November -	2,512	2,887	2,922	3,382	3,106	4,154	4,384	4,357	4,807	—
December -	5,802	6,646	4,663	5,543	5,118	7,344	5,114	5,878	7,188	—
Total -	108,252	79,987	72,105	64,034	76,109	84,532	84,599	146,187	120,716	88,760

International Fisheries Exhibition. International Health Exhibition. International Inventions Exhibition.

Total number of visitors during 10 years - - 925,281

At the Bethnal Green Museum there exist no means of distinguishing those who come expressly to study portraits from general visitors to other Departments.

Signed, by order of the Board,
GEORGE SCHARF.

National Portrait Gallery Offices,
20, Great George Street, Westminster,
Thursday, 7th June 1894.

SUPPLEMENT.

Visit to the New Building, 14th June 1894.

A meeting for viewing the new building having been arranged with the architect, Mr. Ewan Christian, the Trustees on Thursday, 14th June 1894, assembled, for the first time, within its walls.

The following members of the Trust were present :—

1. Lord De L'Isle and Dudley, Vice-Chairman.
2. Lord Ronald Gower.
3. Viscount Cobham.
4. Viscount Dillon.
5. Sir Coutts Lindsay, Bart.
6. Sir J. Everett Millais, Bart., R.A.
7. Sir Charles Tennant, Bart.
8. H. H. Gibbs, Esq.

Letters were received from Lord Edmond Fitzmaurice and Sir F. Leighton expressing regret that they were unable to attend.

Mr. Scharf was present, and Mr. Christian carefully explained the general architectural construction and disposition of the various apartments, and the uses designed for them on all the floors, together with arrangements for heating and ventilation.

The Trustees were impressed with the completeness with which every portion had been thought out and the care with which all necessities had been provided for.

The walls and flooring are fire-proof, and the lighting in the principal galleries is excellent.

Modern appliances and improvements have not been neglected, and wide staircases, with lifts, will facilitate both public and private access to all parts.

The Trustees feel that their valued friend and Colleague at their Board, Mr. W. H. Alexander, the munificent donor of this stately edifice, may be warmly congratulated on the completeness with which his noble scheme is being carried into effect.

Signed, by order of the Board,
GEORGE SCHARF.

National Portrait Gallery Offices,
20, Great George Street, Westminster,
July 1894.

PATENT OFFICE.

ELEVENTH REPORT

OF

THE COMPTROLLER GENERAL

OF

PATENTS, DESIGNS, AND TRADE MARKS,

WITH

APPENDICES

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

Pursuant to Sec. 102 of the Patents, Designs, and Trade Marks Act, 1883 (46 & 47 Vic. c. 57).

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY DARLING & SON, LTD., 1, 2, 3, & 5, GREAT ST. THOMAS APOSTLE, E.C.

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1894.

[C. 7386] *Price* 2½*d.*

CONTENTS.

	PAGE.
1. Report of Comptroller General	3
2. Balance Sheet of Income and Expenditure	8
3. List of Staff, and Account of Salaries	8
4. Receipts from Patents	9
5. Tables showing the Number of Applications for Patents &c. in each Year	10
6. Table showing Number of Specifications filed under Act of 1883	11
7. Table showing the Number of Patents kept in force by Payment of Renewal Fees	11
8. Table showing percentage of Patents kept in force by Payment of Renewal Fees	12
9. Table showing Number of Patents expired through non-payment of Renewal Fees	12
10. Table showing percentage of Patents expired through non-payment of Renewal Fees	13
11. Table showing the Number of Hearings before the Comptroller	13
12. Receipts from Designs	14
13. Classified Table of Trade Marks	15
14. Receipts from Trade Marks	16
15. Designs Rules, 1893	16
16. List of Abridgment Classes published in 1893	19
17. Lists of places supplied with Publications of Patent Office	20

ELEVENTH REPORT

OF THE

COMPTROLLER GENERAL.

In pursuance of the requirements of the 102nd. Section of the Patents, Designs, and Trade Marks Act, 1883 (46 and 47 Vict., c. 57), I have the honour to report as follows upon the proceedings which took place in the year 1893 under the Patents, &c. Acts, 1883–1888.

The general business of the office, as compared with that of previous years, is exhibited in the subjoined statement.

TOTAL NUMBER OF APPLICATIONS FOR PATENTS, DESIGNS, AND TRADE MARKS AND AMOUNT OF GROSS RECEIPTS AND EXPENDITURE IN EACH YEAR, FROM 1884 to 1893 INCLUSIVE.

Years.	Patents.	Designs.		Trade Marks.	Gross Receipts.	Gross Expenditure.
		Single.	Sets.			
	No.	No.	No.	No.	£	£
1884	17,110	19,515	238	7,104	103,827	64,123
1885	16,101	20,388	337	8,026	88,509	77,739
1886	17,176	23,717	324	10,677	106,754	*109,567
1887	18,051	25,734	309	10,586	124,279	81,577
1888	19,103	25,923	316	13,315	149,623	83,924
1889	21,009	24,370	335	11,316	172,820	79,286
1890	21,307	22,235	318	10,258	192,606	83,240
1891	22,888	21,673	277	10,787	203,520	*103,180
1892	24,169	19,269	258	9,101	199,859	*96,822
1893	25,120	19,174	306	8,675	174,878	*95,103

* Including expenditure on account of new offices and buildings.

P 10189—750—4/94 Wt 2008 D & S. A 2

PATENTS.

THE following TABLE shows the NUMBER of APPLICATIONS for PATENTS from PERSONS residing in the UNITED KINGDOM, and in various COUNTRIES and COLONIES, in each of the Years 1884–93, inclusive :—

From persons resident in	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.
UNITED KINGDOM :—	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
England and Wales	12,356	11,254	12,049	12,618	13,598	14,599	14,003	15,484	16,272	17,075
Scotland	901	905	972	916	946	1,030	1,005	1,177	1,260	1,281
Ireland	254	208	232	257	281	362	361	356	363	575
Channel Islands	—	12	6	9	18	22	26	10	18	18
Isle of Man	—	6	6	5	8	7	8	10	12	8
BRITISH COLONIES AND POSSESSIONS :—										
Australia :—										
New South Wales	14	15	18	24	38	61	57	39	52	34
Queensland	1	—	2	6	2	2	7	9	7	6
South Australia	4	5	2	10	20	10	11	10	7	11
Victoria	19	22	25	39	58	44	68	79	65	85
West Australia	—	—	—	1	—	—	2	2	—	2
Bermuda	—	—	—	—	—	1	—	—	—	—
British Burmah	2	—	—	1	1	4	4	1	3	—
British Columbia	—	—	—	—	—	—	—	1	—	1
British Guiana	1	1	—	—	4	2	1	2	2	—
British Honduras	—	—	—	—	1	—	—	—	—	—
Canada	63	80	128	97	99	100	120	134	137	133
Cape of Good Hope	7	10	3	2	2	4	2	7	19	14
Ceylon	—	1	6	2	3	4	12	6	1	6
Fiji	—	1	—	—	—	—	—	1	—	—
Gibraltar	2	2	—	—	1	1	2	3	1	3
Hong Kong	—	—	—	—	—	—	—	—	1	1
India	40	26	38	28	51	43	30	63	51	62
Malta	—	—	—	—	5	—	1	—	3	1
Mauritius	—	1	—	2	—	—	2	—	2	—
Natal	3	—	1	—	—	4	3	8	2	10
Newfoundland	2	5	2	1	2	1	1	—	—	2
New Zealand	16	25	31	38	47	55	48	53	52	61
St. Helena	—	—	—	—	—	1	—	—	—	—
Straits Settlements	—	2	—	1	3	1	4	1	2	3
Tasmania	—	1	2	—	—	1	1	—	2	2
West Indies	6	5	9	4	5	8	7	6	9	16
FOREIGN STATES :—										
EUROPE—										
Austria	151	156	146	165	184	212	237	247	259	261
Belgium	114	121	144	137	155	126	123	116	152	165
Bulgaria	—	—	—	—	—	—	1	—	—	1
Denmark	25	24	20	35	41	55	32	36	27	41
France	788	701	728	762	702	677	772	793	847	866
Germany	890	869	871	961	1,031	1,336	1,336	1,466	1,791	1,864
Greece	—	—	—	—	—	1	2	—	—	1
Holland	31	29	22	33	29	26	33	41	45	41
Italy	39	36	40	31	29	46	45	48	78	50
Norway	8	7	11	7	19	15	23	22	22	19
Portugal	2	—	6	2	3	4	6	4	1	1
Roumania	—	—	1	—	1	2	4	7	5	4
Russia	38	41	30	35	35	53	57	58	52	49
Servia	—	—	—	—	—	—	1	2	5	—
Spain	17	23	25	21	37	27	42	28	22	22
Sweden	42	41	40	47	31	41	44	53	50	60
Switzerland	67	56	68	76	117	104	120	78	96	100
Turkey	4	2	5	7	8	4	2	3	1	2
ASIA—										
Asia Minor	1	—	1	—	—	3	1	2	2	3
China	—	3	2	1	2	6	1	2	4	4
Japan	2	1	1	5	2	2	4	5	4	4
Malay Peninsula	—	—	—	—	—	1	—	—	—	—
Persia	—	—	—	—	—	1	—	—	—	1
Siam	—	—	—	—	1	6	1	2	2	1
Sunda Islands	—	—	2	1	2	2	1	2	—	—
AFRICA—										
Algeria	3	4	—	2	3	3	—	—	2	1
Canary Islands	—	—	—	—	—	1	1	1	—	—
Egypt	3	4	3	3	3	—	2	3	5	5
South Africa	—	—	8	5	9	11	11	5	21	36
West Africa	—	—	—	1	—	—	—	—	—	—
Madeira	—	—	—	1	—	—	—	—	—	—
Réunion	—	—	—	—	—	—	—	1	—	—
AMERICA—										
Argentine Republic	2	2	4	1	1	4	6	9	8	7
Brazil	7	4	5	14	4	8	6	13	4	1
Central America	1	2	2	2	2	1	2	2	—	3
Mexico	1	—	—	1	1	3	1	3	10	5
South America (undefined)	2	6	10	1	—	2	6	9	2	9
United States	1,181	1,382	1,447	1,632	1,457	1,857	2,597	2,364	2,308	2,082
SANDWICH ISLANDS	—	—	2	1	1	1	1	1	1	1
NEW CALEDONIA	—	—	—	—	—	1	—	—	—	—
Total applications	17,110	16,101	17,176	18,051	19,103	21,009	21,307	22,888	24,169	25,120

PATENTS—*continued.*

Applications in 1893.

The number of Applications for patents in the year 1893 exceeded that of any previous year, having amounted to 25,120—or an increase of about four per cent. above the number of Applications in the year 1892.

A new table is given in Appendix G showing the annual increase in the number of Applications and Specifications received under the Act. Neglecting a comparison of the figures for the years 1884 and 1885—as the majority of the Applications filed in 1884 were not completed until 1885—it will be observed that while the average yearly increase in the number of Applications accompanied by Provisional Specifications was about five per cent., the average yearly increase in the number of Applications accompanied by Complete Specifications was about eight per cent. On the other hand the number of Complete Specifications filed after Provisional Specifications only increased at the rate of about two per cent. These figures show (1) that the practice of filing a Complete Specification at the time of Application is growing in favour; and (2) that every year the number of Applications accompanied by Provisional Specifications which are allowed to lapse through omission to file Complete Specifications becomes relatively larger. The average yearly increase in the total number of Specifications filed has been about four and a half per cent.

Number of Applications and of Patents remaining in force.

Tabular statements of the number of Applications and of the number of Patents remaining in force under the Acts of 1852 and 1883 are given in Appendices E and F., and Appendices H, H^1, and I, I^1 illustrate the operation of the renewal fees upon the duration of patents granted.

The reduction in the scale of renewal fees sanctioned in 1892 has caused a small increase in the number of patents kept in force.

International Union.

The number of Applications for patents in this country under the provisions of the International Convention for the protection of industrial property amounted to 174.

Applications for Amendments of Specifications.

One hundred and twenty-three Applications for amendments of specifications before the sealing of the patent and 83 applications for amendments after the sealing were received during the year.

Hearings by Comptroller.

The number and results of the hearings by the Comptroller during the year in respect of oppositions to the grants of patents, and to proposed amendments of Specifications, as well as of those in connection with the exercise of the discretionary power conferred by Section 94 of the Act, are set forth in Appendix J.

Applications to the Privy Council.

Three applications were made to the Privy Council in 1893 for extensions of the terms of patents; of these, one patent was extended for seven years, one application was withdrawn, and one was not decided at the end of the year.

Free library.

The number of readers frequenting the Patent Office library continues to increase—108,712 persons having availed themselves of its use in 1893. The library is open to the public upon week days from 10 a.m. till 10 p.m.

New Patent Office.

The building of the new warehouse and sale branch, which will form the south side of the re-constructed Patent Office, was begun in 1893, and will probably be completed in the course of the present year.

Publications.

Reports of 44 patent cases tried in courts of law in the United Kingdom during 1893 were published in accordance with the requirement of Section 40 (1) of the Act, as well as 22 reports of trade mark cases, and three reports of design cases.

The receipts, in cash, from the sale of official publications during the year amounted to £6,193 19*s.* 7*d.*, which sum was paid over to the Stationery Office.

The first instalment of the new series of classified illustrated abridgments consisting of 120 volumes, relating to patents granted between the years 1877 to 1883 inclusive, was issued during the year, as well as eight volumes of un-illustrated abridgments belonging to the same period. A list of these volumes is given in Appendix O.

Presentation of additional sets of United States Specifications.

In the month of July the United States Government placed eleven additional sets of the Specifications of American patents at the disposal of the Board of Trade—one set of which has been presented to each of the following public libraries, viz.:—Birmingham, Bristol, Cardiff, Dundee, Edinburgh, Glasgow, Leeds, Manchester, and Sheffield.

Receipts and expenditure.

A balance sheet of receipts and expenditure is printed in Appendix A, and tables of the various branches of receipt and an account of the amounts paid for salaries and allowances, as required by Section 102 of the Act, are printed in Appendices B., C. and D.

Donations.

A list of public institutions and public offices receiving grants of Patent Office publications will be found in Appendix P.

Register of Patent Agents.

The names of eight gentlemen were added to the register of Patent Agents during the year. The total number upon the register upon the 31st December 1893 amounted to 237.

DESIGNS.

Number of designs applied for.

The number of designs applied for during the year amounted to 19,174, exclusive of 306 "sets" of designs. In the previous year, 19,269 single designs, and 258 "sets" were applied for. The term "set" includes any number of articles ordinarily on sale together, irrespective of the varieties of the size or arrangement in which the particular design may be shown on each separate article.

Number applied for in each class, and receipts therefrom.

The number of designs applied for in each class during the year, and the amount of fees received in respect thereof, will be found in Appendix K.

Number of similar designs refused.

Four hundred and twenty-three designs were refused registration during 1893, on account of their similarity to designs already registered.

Objections.

During the year, 1,292 applications for registration of designs (including the above-mentioned 423) were objected to by the Comptroller. The objections, other than those on account of similarity to designs already registered, were chiefly on account of want of subject-matter or want of substantial novelty.

Hearings by the Comptroller under Section 94.

Of the 1,292 cases objected to, the applicants in 1,092 cases acquiesced in the objections raised by the Comptroller without applying for a hearing. As regards the 200 others, 133 were accorded hearings with the following results:—56 applications were accepted without alteration; 50 were refused; and 27 were accepted, subject to modification. The remaining 67 applications were allowed, after correspondence, to proceed.

Lace Designs.

The new reduced scale of fees for Lace Designs had not, up to the end of the year 1893, been sufficiently long in operation to furnish material for any special report.

New Rules.

The Designs Rules made in 1893 by the Board of Trade under the Patents, &c. Acts are reprinted in Appendix N.

TRADE MARKS.

Applications.

The total number of applications for the registration of trade marks during the year (including 106* applications to the Cutlers' Company of Sheffield), was 8,675, as compared with 9,101 applications in the previous year.

Trade Marks advertised and registered.

During the same period 3,717 trade marks were advertised and 3,522 trade marks were registered.

Hearings under Section 94.

1,628 hearings under Section 94 took place during the year.

Oppositions under Section 69.

One hundred and forty-five notices of opposition to the registration of trade marks were lodged during the year 1893. Eighty cases of opposition were heard during the year under Section 69. In nine of these there were appeals to the Board of Trade, eight of which appeals were referred by the Board to the Court, whilst the remaining one has not yet been so referred. In one of the cases referred the appeal was abandoned; in two cases the Comptroller's decision was upheld; in one case (on fresh evidence being filed and the Respondents not appearing) the Comptroller's decision was reversed; and four cases still remain undecided.

Appeals to Board of Trade under Section 62.

During the year there were 56 appeals to the Board of Trade from decisions of the Comptroller under Section 62. Of these, 7 were withdrawn, or not duly prosecuted by the Appellants, 30 were heard by the Board of Trade, and 19 were referred by the Board to the Court. Of the 30 appeals heard by the Board, 14 were allowed and 16 were dismissed. Of the 19 appeals referred by the Board to the Court, 4 were abandoned by the appellants, 2 were allowed, 2 were allowed on certain conditions, 3 were dismissed, and 8 remain undecided.

Receipts from Trade Marks.

The total receipts from various sources on account of trade marks in the year 1893, amounted to £8,807 13*s.* 10*d.*, including the sum of £1,549 10*s.* 0*d.* on account of renewal fees. *See* Appendix M.

All which I have the honour most humbly to report.

H. READER LACK,

Comptroller.

The Patent Office,

23*rd May* 1894.

---

* Of this number, 21 were in respect of Old Corporate Marks, for which no fee is charged.

APPENDICES.

APPENDIX A.

BALANCE SHEET of INCOME and EXPENDITURE for the Year ended 31st December 1893.

RECEIPTS.	£	s.	d.	PAYMENTS.	£	s.	d.
				Salaries, &c. (*See* Appendix B.)	54,007	19	2
Patent Fees. (*See* Appendix D.)	155,828	12	10	Pensions	2,110	0	0
				Compensations	1,150	0	0
				Current and Incidental expenses. (*See* Appendix C.)	2,798	1	0
Designs Fees. (*See* Appendix K.)	4,047	7	0	Cost of Stationery supplied by Her Majesty's Stationery Office, books for the Free Library, and binding, &c.	2,300	0	0
Trade Marks Fees. (*See* Appendix M.)	8,807	13	10	Rent of offices, rates, taxes, and insurance	1,141	3	6
				New works (including purchase of premises)	7,576	12	5
Sale of Publications	6,193	19	7	Messrs. Darling and Son for printing specifications of patents, indexes, &c., and lithographer's bills for drawings accompanying specifications; and miscellaneous printing	21,200	0	0
				Cost of paper supplied to the printer and lithographer by Her Majesty's Stationery Office	1,600	0	0
				Cost of coals and other fuel supplied to the Patent Office by Her Majesty's Office of Works, and furniture and repairs	1,218	17	9
					95,102	13	10
				Surplus for the Year 1893	79,774	19	5
	£174,877	13	3		£174,877	13	3

APPENDIX B.

STATEMENT showing the LIST of the STAFF and AMOUNTS PAID ON ACCOUNT of SALARIES, &c., 1st January to 31st December 1893.

List of Staff.	Amount of Salaries for the Year 1893.		
	£	s.	d.
Comptroller General	1,500	0	0
Registrar of Designs and Trade Marks	1,000	0	0
Superintendent of Publications	1,000	0	0
Chief Examiner	793	5	6
Four Principals	2,382	17	7
Librarian	600	0	0
Superintendent of Store Branch	500	0	0
Clerk of Trade Marks Register	450	0	0
Three Staff Clerks Trade Marks	919	4	10
Three Examiners	1,764	12	5
Fifty-one Assistant Examiners	19,540	16	1
Eight Second-class Clerks	3,430	0	0
One Third-class Clerk	300	0	0
One Higher Division Clerk	318	2	9
Thirty-nine Second Division Clerks	6,667	9	5
One Law Clerk	374	16	1
Index Clerk	209	2	9
Two Extra Clerks	425	0	0
Compositor of Trade Marks Journal	265	0	0
Two Sorters of Designs	337	4	6
Two Custodians in Library	293	1	7
Record Keeper	165	1	1
Twenty Abstractors	1,867	18	0
" " (overtime)	275	12	6
Draftsman	151	7	6
Office Keeper	161	16	2
Designs Messenger and Sealer	130	0	0
Twenty-six Attendants, Messengers, and Warehousemen	2,294	8	0
Fireman	91	14	5
Temporary Fireman	48	13	0
Copyists	3,184	14	9
Temporary Messengers	119	6	3
Charwomen	601	14	0
Abridging and Indexing (Arrears)	139	1	0
Results Pay to Examining Staff	28	12	4
Index to Official Journal	98	0	0
Manchester Branch (Trade Marks Registry)—			
Keeper of Cotton Marks	600	0	0
Assistant Keeper of Cotton Marks	264	16	9
Registration and Consent Clerk	134	16	1
2 Sorters (Permanent)	210	11	10
Sorters (Temporary)	343	2	0
Cleaning offices	26	0	0
	£54,007	19	2

APPENDIX C.

Current and Incidental Expenses.

	£	s.	d.
Police	433	16	6
Shorthand Writers' Notes :—			
For Patents, Designs, and Trade Marks Reports	699	2	8
„ Hearings before Law Officers and Comptroller	710	18	0
International Bureau	139	4	0
Travelling Expenses	18	19	6
Assessors-	105	0	0
Incidentals	691	0	4
	£2,798	1	0

APPENDIX D.

PATENTS BRANCH.

Account of Fees Received from the 1st January to 31st December 1893.

Description of Documents, &c.	Number.	Fees.	Amount Received.
		Each.	£ s. d.
Applications for Patents.—(21,197 with Provisional Specification, and 3,923 with Complete Specification)	25,120	1*l.*	25,120 0 0
Complete Specification.—(In the first instance, 3,923 ; filed after Provisional, 7,980)	11,903	3*l.*	35,709 0 0
Entries of Assignments. Licences, &c.	1,609	10*s.*	804 10 0
Applications to amend Specification : before sealing	123	1*l.* 10*s.*	184 10 0
„ „ „ after „	83	3*l.*	249 0 0
Certificates of Comptroller	275	5*s.*	68 15 0
Notices of Opposition to Grant of Patent	188	10*s.*	94 0 0
„ „ Amendment of Specification	15	10*s.*	7 10 0
Hearings before Comptroller.—(Oppositions to Grants and Amendments.)—(Hearing Fees)	265	1*l.*	265 0 0
Appeals to Law Officers	31	3*l.*	93 0 0
Requests to Comptroller to correct clerical errors : before sealing	55	5*s.*	13 15 0
„ „ „ after „	13	1*l.*	13 0 0
Applications for Duplicate of Patent	8	2*l.*	16 0 0
Applications for 1 month's enlargement of time for payment of Renewal Fee	420	1*l.*	420 0 0
„ 2 „ „ „ „	80	3*l.*	240 0 0
„ 3 „ „ „ „	160	5*l.*	800 0 0
Notices of intended exhibition of Unpatented Inventions	10	10*s.*	5 0 0
Searches	2,362	1*s.*	118 2 0
Postal requests for printed copies of Specifications	15,748	7½*d.*	492 2 6
Folios of Office Copies of Documents	7,609	4*d.*	126 16 4
Certificates on Office Copies	482	1*s.*	24 2 0
Annual Instalments for continuing the Patent in force	3,359	5*l.*	16,795 0 0
	2,182	6*l.*	13,092 0 0
	1,688	7*l.*	11,816 0 0
	1,378	8*l.*	11,024 0 0
	1,162	9*l.*	10,458 0 0
	965	10*l.*	9,650 0 0
	453	11*l.*	4,983 0 0
	360	12*l.*	4,320 0 0
	282	13*l.*	3,666 0 0
	218	14*l.*	3,052 0 0
Application for 1 month's enlargement of time for filing Complete Specification	845	2*l.*	1,690 0 0
„ 1 „ „ „ accepting Complete Specification.	156	2*l.*	312 0 0
„ 2 „ „ „ „	13	4*l.*	52 0 0
„ 3 „ „ „ „	9	6*l.*	54 0 0
Application for prolongation of Patent	1	10*s.*	0 10 0
			£155,828 12 10

APPENDIX E.

NUMBER of APPLICATIONS for PATENTS, PATENTS SEALED, &c., under Act of 1852.

Years.	No. of Applications for Patents.	No. of Patents sealed thereon.	No. of such Patents void for want of Final Specifications.	No. of such Patents remaining in force to end of		
				3rd Year, or in case of Patents subsequent to 1880 to end of 4th Year.	7th Year.	14th Year.
1852	1,211	914	23	891	310	102
1853	3,045	2,187	74	2,143	621	205
1854	2,764	1,878	66	1,812	513	140
1855	2,958	2,046	52	1,994	551	195
1856	3,106	2,094	47	2,047	573	214
1857	3,200	2,028	52	1,976	584	221
1858	3,007	1,954	31	1,923	540	197
1859	3,000	1,977	39	1,938	542	217
1860	3,196	2,063	47	2,016	579	194
1861	3,276	2,047	35	2,012	575	179
1862	3,490	2,191	35	2,156	646	214
1863	3,309	2,094	28	2,066	632	215
1864	3,260	2,024	22	2,002	550	178
1865	3,386	2,186	27	2,159	582	193
1866	3,453	2,124	24	2,100	574	227
1867	3,723	2,284	31	2,253	619	260
1868	3,991	2,490	34	2,456	729	272
1869	3,786	2,407	41	2,366	793	309
1870	3,405	2,180	40	2,140	738	280
1871	3,529	2,376	38	2,338	819	307
1872	3,970	2,771	37	2,734	853	291
1873	4,294	2,974	68	2,906	856	281
1874	4,492	3,162	58	3,104	953	301
1875	4,561	3,112	63	3,049	895	295
1876	5,069	3,435	68	3,367	947	341
1877	4,949	3,317	58	3,259		
1878	5,343	3,509	71	3,438		
1879	5,338	3,524	60	3,464		
1880	5,517	3,741	67	3,674		
1881	5,751	3,950	68	3,882		
1882	6,241	4,337	77	4,260		
1883	5,993	3,962	64	3,898		

Upon the Patents of 1877 and subsequent years Annual Renewal Fees became payable. *See* Appendix H.

NOTE.—The number of Patents sealed before 1852 was 13,561.

APPENDIX F.

NUMBER of APPLICATIONS for PATENTS, &c., under Act of 1883.

Years.	No. of Applications for Patents.	No. of Applications abandoned. § 8 s.s. 2.	No. of Applications void. § 9 s.s. 4.	No. of Applications open to Inspection under §10, but not proceeded with to the Sealing Stage.	No. of Applications on which Patents were refused. § 11.	No. of Patents Sealed and remaining in force to end of 4th year.
1884	17,110	7,012	63	39	12	9,984
1885	16,101	7,236	58	22	10	8,775
1886	17,176	7,946	79	36	10	9,105
1887	18,051	8,435	76	63	20	9,457
1888	19,103	9,152	77	38	16	9,820
1889	21,009	10,225	90	18	11	10,665
1890	21,307	10,565	100	25	18	10,599
1891	22,888	11,796	122	22	25	10,928
1892	24,169	12,402	122	68	22	11,555
1893	25,120					

APPENDIX G.

Number of Specifications, Provisional and Complete, filed under Act of 1883.

Year.	On application.						Complete Specifications filed after Provisional Specifications.		Total Complete Specifications.		Total Specifications.	
	Provisional Specifications.		Complete Specifications.		Total Specifications.							
	No.	Increase per cent. upon previous year.	No.	Increase per cent. upon previous year.	No.	Increase per cent. upon previous year.	No.	Increase per cent. upon previous year.	No.	Increase per cent. upon previous year.	No.	Increase per cent. upon previous year.
1884	15,253	—	1,857	—	17,110	—	3,613	—	5,470	—	20,723	—
1885	13,997	[— 8·2]	2,104	13·3	16,101	[— 5·9]	6,900	91·0	9,004	64·6	23,001	11·0
1886	14,834	5·9	2,342	11·3	17,176	6.7	6,845	[— 0·8]	9,187	2·0	24,021	4·4
1887	15,491	4·4	2,560	9·3	18,051	5·1	7,002	2·3	9,562	4·1	25,053	4·3
1888	16,422	6·0	2,681	4·7	19,103	5·8	7,098	1·4	9,779	2·3	26,201	4·6
1889	17,754	8·1	3,255	21·4	21,009	10·0	7,332	3·3	10,587	8·3	28,341	8·2
1890	17,899	0·8	3,408	4·7	21,307	1·4	7,266	[— 0·9]	10,674	0·8	28,573	0·8
1891	19,377	8·3	3,511	3·0	22,888	7·4	7,555	4·0	11,066	3·7	30,443	6·6
1892	20,322	4·9	3,847	9·6	24,169	5·6	7,615	0·8	11,462	3·6	31,784	4·4
1893	21,197	4·3	3,923	2·0	25,120	4·0	7,980	4·8	11,903	3·8	33,100	4·1
Average yearly increase from 1886.	900	5·3	227	8·3	1,127	5·8	135	1·9	362	3·6	1,262	4·7

APPENDIX H.

Number of Patents kept in force by Payment of Renewal Fees.

YEAR.	No. of Patents remaining in force to end of 3rd year, or in the case of Patents subsequent to 1880, to end of 4th year.	NUMBER KEPT IN FORCE TO END OF												
		7th year, or in the case of Patents subsequent to 1883, 8th year, £50.	14th year, £100.	5th year.	6th year.	7th year.	8th year.	9th year.	10th year.	11th year.	12th year.	13th year.	14th year.	YEAR.
(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)	(8.)	(9.)	(10.)	(11.)	(12.)	(13.)	(14.)	(15.)
1877	3,259	981	*250	...	...	...	214	170	152	127	106	86	70	1877
1878	3,438	1,113	35	...	...	...	567	457	411	341	294	244	192	1878
1879	3,464	1,108	23	...	...	...	574	487	427	355	316	231	175	1879
1880	3,674	1,174	22	...	...	...	628	531	459	391	340	281	222	1880
1881	3,882	96	12	1,259	959	782	741	617	516	417	354	291	...	1881
1882	4,260	52	12	1,419	1,090	904	772	629	539	441	357	...	...	1882
1883	3,898	35	3	1,420	1,076	862	758	621	509	429	...	...	...	1883
1884	9,984	32	1	2,889	2,105	1,714	1,421	1,172	1,001	...	...	...	...	1884
1885	8,775	40	...	2,645	2,009	1,610	1,341	1,162	...	...	...	...	...	1885
1886	9,105	19	...	2,705	2,051	1,657	1,381	...	...	...	...	...	...	1886
1887	9,457	13	...	2,809	2,098	1,702	...	...	...	...	...	...	...	1887
1888	9,820	4	...	2,836	2,178	...	...	...	...	...	...	...	...	1888
1889	10,665	...	...	3,369	...	...	...	...	...	...	...	...	...	1889
1890	10,599	...	...	...	...	...	...	...	...	...	...	...	...	1890
1891	10,923	...	...	...	...	...	...	...	...	...	...	...	...	1891
1892	11,555	...	...	...	...	...	...	...	...	...	...	...	...	1892

* The provision allowing the £100 fee to be paid in yearly instalments did not apply to the earlier numbers of the year 1877

APPENDIX H[1].

Percentage of Patents kept in Force by Payment of Renewal Fees.

YEAR.	Number, per 100 applications, of Patents sealed and in force for 3 or 4 years. (Col. 2 of Appendix G.).	NUMBER, PER 100 SEALED PATENTS IN FORCE FOR 3 OR 4 YEARS, OF PATENTS KEPT IN FORCE TO END OF												YEAR.
		7th or 8th year (Col. 3 of App. G.).	14th year (Col. 4 of App. G).	5th year (Cols. 3 and 5 of App. G.).	6th year (Cols. 3 and 6 of App. G.).	7th year (Cols. 3 and 7 of App. G.).	8th year (Cols. 4 and 8 of App. G.).	9th year (Cols. 4 and 9 of App. G.).	10th year (Cols. 4 and 10 of App. G.).	11th year (Cols. 4 and 11 of App. G.).	12th year (Cols. 4 and 12 of App. G.).	13th year (Cols. 4 and 13 of App. G.).	14th year (Cols. 4 and 14 of App. G.).	
(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)	(8.)	(9.)	(10.)	(11.)	(12.)	(13.)	(14.)	(15.)
1877	65·8	30·1	...	...	...	...	14·2	12·8	12·3	11·6	10·9	10·3	9·8	1877
1878	64·3	32·4	...	...	...	...	17·5	14·3	13·0	10·9	9·6	8·1	6·6	1878
1879	64·9	32·0	...	...	...	...	17·2	14·7	13·0	10·9	9·8	7·3	5·7	1879
1880	66·6	32·0	...	...	...	...	17·7	15·1	13·1	11·2	9·9	8·2	6·6	1880
1881	67·5	...	...	34·9	27·2	22·6	19·4	16·2	13·6	11·1	9·4	7·8	...	1881
1882	68·3	...	...	34·5	26·8	22·4	18·4	15·0	12·9	10·6	8·7	...	...	1882
1883	65·0	...	...	37·3	28·5	23·0	19·5	16·0	13·1	11·1	...	...	...	1883
1884	58·3	...	...	29·2	21·4	17·5	14·6	11·7	10·0	...	...	...	...	1884
1885	54·4	...	...	30·6	23·4	18·8	15·7	13·2	...	...	...	...	...	1885
1886	53·0	...	...	29·9	22·7	18·4	15·4	...	...	...	...	...	...	1886
1887	52·4	...	...	29·8	22·3	18·1	...	...	...	...	...	...	...	1887
1888	51·4	...	...	28·9	22.2	...	...	...	...	...	...	...	...	1888
1889	50·8	...	...	31·6	...	...	...	...	...	...	...	...	...	1889
1890	49·7	...	...	...	...	...	...	...	...	...	...	...	...	1890
1891	47·7	...	...	...	...	...	...	...	...	...	...	...	...	1891
1892	47·8	...	...	...	...	...	...	...	...	...	...	...	...	1892

APPENDIX I.

Number of Patents expired through non-payment of Renewal Fees.

YEAR.	No. of Patents remaining in force to end of 3rd year, or in the case of Patents subsequent to 1880, to end of 4th year.	Number expiring at commencement of											YEAR.
		4th year.	5th year.	6th year.	7th year.	8th year.	9th year.	10th year.	11th year.	12th year.	13th year.	14th year.	
(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)	(8.)	(9.)	(10.)	(11.)	(12.)	(13.)	(14.)
1877	3,259	2,278	...	...	...	517	44	18	25	21	20	16	1877
1878	3,438	2,325	...	...	...	511	110	46	70	47	50	52	1878
1879	3,464	2,356	...	...	...	511	87	60	72	39	85	56	1879
1880	3,674	2,500	...	...	...	524	97	72	68	51	59	59	1880
1881	3,882	...	2,527	300	177	125	124	101	99	63	63	...	1881
1882	4,260	...	2,789	329	186	72	143	90	98	84	...	...	1882
1883	3,898	...	2,443	344	214	136	137	112	80	...	...	...	1883
1884	9,984	...	7,063	784	391	293	280	171	...	...	...	...	1884
1885	8,775	...	6,090	636	399	269	219	...	...	...	...	...	1885
1886	9,105	...	6,381	654	394	276	...	...	...	...	...	...	1886
1887	9,457	...	6,635	711	396	...	...	...	...	...	...	...	1887
1888	9,820	...	6,980	658	...	...	...	...	...	...	...	...	1888
1889	10,665	...	7,296	...	...	...	...	...	...	...	...	...	1889
1890	10,599	...	...	...	...	...	...	...	...	...	...	...	1890
1891	10,9[illegible]	...	...	...	...	...	...	...	...	...	...	...	1891
1892	11,555	...	...	...	...	...	...	...	...	...	...	...	1892

APPENDIX I.

PERCENTAGE OF PATENTS EXPIRED THROUGH NON-PAYMENT OF RENEWAL FEES.

YEAR.	Number, per 100 Applications, of Patents Sealed and in force for 3 or 4 years.	Number, per 100 sealed Patents in force for 3 or 4 years, of Patents expiring at commencement of										YEAR.
		4th year.	5th year.	6th year.	7th year.	8th year.	9th year.	10th year.	11th year.	12th year.	13th year.	14th year.	
(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)	(8.)	(9.)	(10.)	(11.)	(12.)	(13.)	(14.)
1877	65·8	69·9	...	...	...	15·9	1·4	·6	·8	·7	·6	·5	1877
1878	64·3	67·6	...	...	...	14·9	3·2	1·3	2·1	1·3	1·5	1·5	1878
1789	64·9	68·0	...	...	...	14·8	2·5	1·7	2·1	1·1	2·5	1·6	1879
1880	66·6	68·0	...	...	...	14·3	2·6	2·0	1·9	1·3	1·7	1·6	1880
1881	67·5	...	65·1	7·7	4·6	3·2	3·2	2·6	2·5	1·7	1·6	...	1881
1882	68·3	...	65·5	7·7	4·4	4·0	3·4	2·1	2·3	1·9	...	...	1882
1883	65·0	...	62·7	8·8	5·5	3·5	3·5	2·9	2·0	...	...	...	1883
1884	58·3	...	70·8	7·8	3·9	2·9	2·9	1·7	...	...	...	...	1884
1885	54·4	...	69·4	7·2	4·6	3·1	2·5	...	...	...	...	...	1885
1886	53·0	...	70·1	7·2	4·3	3·0	...	...	...	...	...	...	1886
1887	52·4	...	70·2	7·5	4·2	...	...	...	...	...	...	...	1887
1888	51·4	...	71·1	6·7	...	...	...	...	...	...	...	...	1888
1889	50·8	...	68·4	...	...	...	...	...	...	...	...	...	1889
1890	49·7	...	...	...	...	...	...	...	...	...	...	...	1890
1891	47·7	...	...	...	...	...	...	...	...	...	...	...	1891
1892	47·8	...	...	...	...	...	...	...	...	...	...	...	1892

APPENDIX J.

HEARINGS (Patents only) before the COMPTROLLER GENERAL under Sections 11, 18, and 94 of the PATENTS, DESIGNS, and TRADE MARKS ACT, 1883.

	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893
NUMBER OF HEARINGS UPON OPPOSITIONS TO GRANTS OF PATENTS	7	68	103	95	117	107	132	119	159	136
NUMBER OF APPEALS TO LAW OFFICER	2	14	17	15	29	27	23	20	32	26
Decision of Comptroller supported	1	9	9	9	14	13	14	13	19	8
" " reversed	1	0	1	2	7	4	5	2	3	3
" " varied	—	5	7	4	7	7	—	4	6	1
Outstanding	—	—	—	—	1	1	1	—	1	8
Withdrawn	—	—	—	—	—	2	3	1	2	6
Application for Patent abandoned	—	—	—	—	—	—	—	—	1	—
NUMBER OF HEARINGS UPON OPPOSITIONS TO AMENDMENTS	9	14	17	8	13	3	8	8	6	12
NUMBER OF APPEALS TO LAW OFFICER	3	7	2	3	2	—	2	1	4	2
Decision of Comptroller supported	1	4	1	1	2	—	1	—	1	—
" " reversed	—	1	1	1	—	—	—	—	—	—
" " varied	2	2	—	1	—	—	1	1	2	1
Withdrawn	—	—	—	—	—	—	—	—	1	1
NUMBER OF HEARINGS UNDER SECTION 94	100	120	110	100	85	75	76	75	72	59
NUMBER OF APPEALS TO LAW OFFICER	3	7	8	5	4	9	3	2	2	—
Decision of Comptroller supported	2	1	3	2	3	2	1	—	1	—
" " reversed	1	3	1	3	—	3	1	—	—	—
" " varied	—	3	4	—	1	1	1	2	1	—
Not subject to appeal	—	—	—	—	—	3	—	—	—	—

APPENDIX K.

DESIGNS BRANCH.

ACCOUNT of FEES RECEIVED from the 1st January to the 31st December 1893.

Classes of Designs, &c.	Number of Applications for Registration.		Fees Charged.		Amount Received.								
	Single Designs.	Sets.	Single Designs.	Sets.	Single Designs.			Sets.			Total.		
					£	s.	d.	£	s.	d.	£	s.	d.
1. Articles of Metal (not included in Class 2)	2,306	82	10s.	1l.	1,153	0	0	82	0	0	1,235	0	0
2. Jewellery	285	3	10s.	1l.	142	10	0	3	0	0	145	10	0
3. Articles of Wood, Bone, Ivory, Papier-mâché, or other solid substances not included in other Classes	546	13	10s.	1l.	273	0	0	13	0	0	286	0	0
4. Articles of Glass, Earthenware, or Porcelain, Bricks, Tiles, or Cement	791	129	10s.	1l.	395	10	0	129	0	0	524	10	0
5. Articles of Paper (except Hangings)	188	1	10s.	1l.	94	0	0	1	0	0	95	0	0
6. Articles of Leather, including Bookbinding of all materials	101	—	10s.	—	50	10	0	—			50	10	0
7. Paper-hangings	133	—	10s.	—	66	10	0	—			66	10	0
8. Carpets and Rugs in all materials, Floor-cloths and Oil-cloths	342	—	10s.	—	171	0	0	—			171	0	0
9. Lace, Hosiery	654	35	10s.	1l.	327	0	0	35	0	0	362	0	0
9A. Lace (at reduced fees from 1st December, 1893)	98	38	1s.	2s.	4	18	0	3	16	0	8	14	0
10. Millinery and Wearing Apparel, including Boots and Shoes	381	3	10s.	1l.	190	10	0	3	0	0	193	10	0
11. Ornamental Needlework on Muslin or other Textile Fabrics	20	—	10s.	—	10	0	0	—			10	0	0
12. Goods not included in other Classes	274	2	10s.	1l.	137	0	0	2	0	0	139	0	0
13. Printed or Woven Designs on Textile Piece Goods	12,543	—	1s.	—	627	3	0	—			627	3	0
14. Printed or Woven Designs on Handkerchiefs and Shawls	512	—	1s.	—	25	12	0	—			25	12	0
	19,174	306											
Inspection Tickets	70		1s.		-	-		-	-		3	10	0
Searches under Section 53 and Rule 35	350		5s.		-	-		-	-		87	10	0
Clerical Errors amended	3		5s		-	-		-	-		0	15	0
Copies of Certificates of Registration	9		1s.		-	-		-	-		0	9	0
Legal Certificates	10		5s.		-	-		-	-		2	10	0
Requests for Subsequent Proprietorship	19 (17)		10s.		-	-		-	-		8	10	0
	19 (1)		1l.		-	-		-	-		1	0	0
	19 (1)		1s.		-	-		-	-		0	1	0
Appeal to Board of Trade	2		1l.		-	-		-	-		2	0	0
Notice of Exhibition of unregistered design	2		5s.		-	-		-	-		0	10	0
Office Copies	11		1s.		-	-		-	-		0	11	0
„ „ Certified	1		2s.		-	-		-	-		0	2	0
					TOTAL			-	-		£4,047	7	0

APPENDIX L.

TRADE MARKS BRANCH.

The following TABLE shows the NUMBER of TRADE MARKS ADVERTISED and the number REGISTERED in the 50 different Classes in 1893 and in the two preceding years, and also the Total Number ADVERTISED and REGISTERED since the 1st January 1876.

Classes.	Classification of Goods.	1891.		1892.		1893.		Total from 1st January 1876.	
		Advertised.	Registered.	Advertised.	Registered.	Advertised.	Registered.	Advertised.	Registered.
		No.	No.	No.	No.	No.	No.	No.	No.
1	Chemical substances used in manufactures and photography, or philosophical research, and anti-corrosives.	86	79	71	75	95	82	1,612	1,476
2	Chemical substances used for agricultural, horticultural, veterinary, and sanitary purposes.	81	79	63	61	93	74	1,330	1,184
3	Chemical substances prepared for use in medicine and pharmacy.	216	183	165	184	222	195	3,982	3,550
4	Raw, or partly prepared vegetable, animal, and mineral substances used in manufactures, not included in other classes.	40	42	74	47	56	76	1,001	914
5	Unwrought and partly wrought metals used in manufacture.	119	120	64	55	78	75	2,955	2,668
6	Machinery of all kinds, and parts of machinery, except agricultural and horticultural machines included in Class 7.	47	51	32	27	37	43	1,382	1,278
7	Agricultural and horticultural machinery and parts of such machinery.	17	20	16	9	10	16	650	607
8	Philosophical instruments, scientific instruments, and apparatus for useful purposes. Instruments and apparatus for teaching.	16	18	17	17	23	24	483	437
9	Musical instruments	13	19	12	12	20	17	346	312
10	Horological instruments	10	16	18	12	8	12	365	331
11	Instruments, apparatus, and contrivances, not medicated, for surgical or curative purposes, or in relation to the health of men or animals.	28	31	24	16	21	27	463	426
12	Cutlery and edge tools	70	55	57	29	50	63	1,822	1,656
13	Metal goods, not included in other classes	147	139	113	110	99	94	3,638	3,323
14	Goods of precious metals (including aluminium, nickel, Britannia metal, &c.) and jewellery, and imitations of such goods and jewellery.	49	51	35	28	29	32	957	881
15	Glass	13	17	18	14	19	17	391	362
16	Porcelain and earthenware	18	22	24	19	26	28	557	505
17	Manufactures from mineral and other substances for building or decoration.	25	26	17	17	14	10	370	327
18	Engineering, architectural, and building contrivances	25	22	28	31	22	15	774	691
19	Arms, ammunition, and stores, not included in Class 20	10	14	9	7	14	13	305	275
20	Explosive substances	14	13	13	16	8	5	262	241
21	Naval architectural contrivances and naval equipments, not included in Classes 19 and 20.	3	7	3	2	8	7	195	170
22	Carriages	50	45	42	45	37	36	490	436
23	Cotton yarn and thread	173	161	70	110	62	60	3,625	3,449
24	Cotton piece goods of all kinds	480	478	167	225	78	78	8,510	8,015
25	Cotton goods not included in Classes 23, 24, or 38	18	22	40	39	29	28	788	734
26	Linen and hemp yarn and thread	20	23	9	19	8	8	401	387
27	Linen and hemp piece goods	38	30	13	21	12	12	552	533
28	Linen and hemp goods, not included in Classes 26, 27, and 50	18	13	10	19	12	10	309	300
29	Jute yarns and tissues, and other articles made of jute not included in Class 50.	14	7	8	15	9	10	157	153
30	Silk, spun, thrown, or sewing	19	14	9	15	14	12	451	426
31	Silk piece goods	23	25	20	24	27	25	531	504
32	Silk goods not included in Classes 30 and 31	16	13	19	23	19	13	397	377
33	Yarns of wool, worsted, or hair	41	34	36	44	24	23	680	649
34	Cloths and stuffs of wool, worsted, or hair	137	124	121	139	68	59	1,942	1,841
35	Woollen, worsted, and hair goods not included in Classes 33 and 34.	32	32	70	73	23	27	771	736
36	Carpets, floor-cloth, oil-cloth, and mats	9	13	11	10	18	15	305	285
37	Leather and skins, unwrought and wrought, and articles made of leather not included in other classes.	21	29	17	14	29	27	506	475
38	Articles of clothing	195	186	165	170	159	165	2,954	2,739
39	Paper (except paper-hangings), stationery, and bookbinding.	154	150	86	89	117	107	2,545	2,208
40	Goods manufactured from india-rubber and gutta-percha not included in other classes.	19	13	23	20	29	29	361	334
41	Furniture and upholstery	12	15	22	18	25	26	367	330
42	Substances used as food, or as ingredients in food	519	485	517	461	507	495	7,412	6,670
43	Fermented liquors and spirits	351	328	303	320	315	302	6,287	5,672
44	Mineral and aërated waters, natural and artificial, including ginger-beer.	94	95	61	74	96	87	1,908	1,637
45	Tobacco, whether manufactured or unmanufactured	421	376	392	378	487	444	5,462	4,827
46	Seeds for agricultural and horticultural purposes	5	7	6	5	7	7	94	85
47	Candles, common soap, detergents, illuminating, heating or lubricating oils, matches, and starch, blue, and other preparations for laundry purposes.	171	157	130	134	159	141	3,485	3,129
48	Perfumery (including toilet articles, preparations for the teeth and hair, and perfumed soap).	117	104	103	114	134	122	2,509	2,150
49	Games of all kinds and sporting articles not included in other classes.	43	40	31	33	30	27	557	487
50	Buttons, brushes, small wares of ivory, bone, jet, and other articles not included in other classes.	199	182	207	210	231	202	3,389	2,968
	TOTAL	4,456	4,225	3,581	3,649	3,717	3,522	81,585	74,147

APPENDIX M.

TRADE MARKS BRANCH.

ACCOUNT of FEES RECEIVED from the 1st January to the 31st December 1893.

Description of Document, &c.	Number.	Fees.	Amount. £	s.	d.
Applications for Registration of Trade Marks : per Patent Office	8,569	5*s.*	2,142	5	0
" " " " per Cutlers' Company	85§	*5*s.*	10	12	6
Appeals to Board of Trade	68	1*l.*	68	0	0
Advertisements : for Additional Space	—	Various rates.	287	16	4
Oppositions	137	1*l.*	137	0	0
Registration of Trade Marks : per Patent Office	3,391	1*l.*	†3,394	4	6
" " " : per Cutlers' Company	64	*1*l.*	32	0	0
Duplicates of Notifications of Registration	74	2*s.*	7	8	0
Certificates of preliminary Procedure	33	5*s.*	8	5	0
" to obtain Registration abroad : per Patent Office	474	5*s.*	118	10	0
" " " " : per Cutlers' Company	1	*5*s.*	0	2	6
" for use in Legal Proceedings	55	1*l.*	55	0	0
" of Refusal	5	1*l.*	5	0	0
Corrections of Clerical Errors : per Patent Office	184	5*s.*	46	0	0
" " " : per Cutlers' Company	8	*5*s.*	1	0	0
Registration of subsequent Proprietors : per Patent Office	1,647	Various rates.	523	16	0
" " " " : per Cutlers' Company	83	*Various rates.	15	0	0
Rectifications of Register	12	10*s.*	6	0	0
Cancelling entries on Register	32	5*s.*	8	0	0
Altering Addresses on Register : per Patent Office	115	5*s.*	28	15	0
" " " : per Cutlers' Company	6	*5*s.*	0	15	0
Folios of Office Copies	414	4*d.*	6	18	0
Certifying Office Copies	29	1*s.*	1	9	0
Searches and Inspections : Head Office	2,674	1*s.*	133	14	0
" " : Manchester Branch	1,593	1*s.*	79	13	0
Applications for Hearings respecting Oppositions : per Patent Office	140	1*l.*	140	0	0
" " " " : per Cutlers' Company	2	*1*l.*	1	0	0
Renewals of Registration of Trade Marks : per Patent Office	1,495	1*l.*	1,495	0	0
" " " " : per Cutlers' Company	79	*1*l.*	39	10	0
Additional Fees received with late Renewal Fees	20	10*s.*	10	0	0
Restoration Fees received with late Renewal Fees	5	1*l.*	5	0	0
TOTAL			£8,807	13	10

* Half of these fees is paid to the Cutlers' Company of Sheffield, consequently only half of the various amounts is returned as Patent Office receipts.

† Including fees for registration of "Series" of Trade Marks.

§ Exclusive of 21 Old Corporate Marks, for which no fee is charged for registration.

APPENDIX N.

DESIGNS RULES, 1893.

WITH FEES AND FORMS.

By virtue of the provisions of the Patents, Designs, and Trade Marks Act, 1883–1888, the Board of Trade do hereby make the following Rules :—

Title and Commencement.

1. These Rules may be cited as the Designs Rules, 1893, and shall come into operation from and immediately after the 30th day of November, 1893.

Fees.

2. For the fees numbered 1, 2 and 3 specified in the First Schedule to the Designs Rules, 1890, shall be substituted the fees specified in the First Schedule hereto.

Forms.

3. For Rule 4 of the Designs Rules, 1890, shall be substituted the following Rule :—

4. An application for the registration of a design for articles not being lace shall be made in the form E or form O in the Second Schedule hereto. An application for one design to be applied to lace shall be made in the form E1 in the Second Schedule hereto, and for one design to be applied to a set of lace articles shall be made in the form O1 in the Second Schedule hereto. A request for registration of the name of any subsequent proprietor of a lace design or set of lace designs shall be made in the form K1 in the Second Schedule hereto. The remaining forms in such Schedule may be used in all cases to which they are applicable.

4. To the forms specified in the Second Schedule to the Designs Rules, 1890, shall be added the forms specified in the Second Schedule hereto.

Registration Marks.

5. For Rule 32 of the Designs Rules, 1890, shall be substituted the following Rule :—

32. Before delivery on sale of any article to which a registered design has been applied, the proprietor of such design shall if such article is included in Class 13 or Class 14 in the Third Schedule hereto cause each such article to be marked with the abbreviation Regd., and shall, if such article is included in any of the Classes 1 to 12 in the Third Schedule hereto, cause each such article to be marked with the abbreviation Rd., and also, in the case of articles other than lace, with the number appearing on the certificate of registration.

A. J. MUNDELLA,
President of the Board of Trade.

18*th November*, 1893.

APPENDIX N—*continued.*

SCHEDULE I.

FEES.

		£	s.	d.
1.	On application to register one design to be applied to single articles in each class not being lace and except articles in Classes 13 and 14	0	10	0
2.	On application to register one design to be applied to lace, or to single articles in Classes 13 and 14	0	1	0
3.	On application to register one design to be applied to a set of articles, not being lace, for each class of registration	1	0	0
3a.	On application to register one design to be applied to a set of lace articles	0	2	0

A. J. MUNDELLA,
President of the Board of Trade

Approved—

For the Lords Commissioners of Her Majesty's Treasury.

FRANK MOWATT.

18*th November*, 1893.

SCHEDULE II.

FORMS.

E1.—Application for Registration of a Lace Design in Class 9.
O1.—Application for Registration of a Lace Design to be applied to a Set.
K1.—Request to enter name of Subsequent Proprietor of a Lace Design or Set of Lace Designs.

DESIGNS.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883–1888.

Form E 1.

APPLICATION FOR REGISTRATION OF A LACE DESIGN IN CLASS 9.

You are hereby requested to register, without search, the accompanying design in Class 9 in the name of (*a*)_____

(*a*) Here insert legibly the name, address, and description of the individual or firm.

who claims to be the proprietor thereof, and to return the same to_____

The nature of the design is the pattern.

(Signed) (*b*)_____

(*b*) To be signed by the Applicant or his Agent duly authorised. When signed by an Agent there should be added to the signature "Agent duly authorised by authorisation dated the day of 189 ."

Dated the_____day of_____189 .

To the Comptroller,
The Patent Office (Designs Branch),
25, Southampton Buildings,
London, W.C.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883–1888.

Form **O 1.**

DESIGNS.

APPLICATION FOR REGISTRATION OF A LACE DESIGN TO BE APPLIED TO A SET.

You are hereby required to register, without search, the accompanying Design for a Set of Lace Articles in Class 9 in the name of (*a*)_____

(*a*) Here insert legibly the name, address, and description of the individual or firm.

who claims to be the proprietor thereof, and to return the same to_____

The nature of the design is the pattern.

(Signed) (*b*)_____

(*b*) To be signed by the Applicant or his Agent duly authorised. When signed by an Agent there should be added to the signature "Agent duly authorised by authorisation dated the day of 189 ."

Dated the _____ day of _____ 189 .

To the Comptroller,
The Patent Office (Designs Branch),
25, Southampton Buildings,
London, W.C.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883–1888.

Form **K 1.**

DESIGNS.

REQUEST TO ENTER NAME OF SUBSEQUENT PROPRIETOR OF A LACE DESIGN OR SET OF LACE DESIGNS.

The Comptroller is requested to enter the name of (*a*)_____

(*a*) Here insert legibly the name, address, and description of the individual or firm.

in respect of the proprietorship of the Registered Lace Design or set of Lace Designs No._____ in Class 9 in place of the name of_____

at present appearing in the Register.

(Signed) (*b*)_____

(*b*) To be signed by the Registered Proprietor and by the Assignee.

Dated the _____ day of _____ 189 .

To the Comptroller,
The Patent Office (Designs Branch),
25, Southampton Buildings,
London, W.C.

A. J. MUNDELLA,
President of the Board of Trade.

18th November, 1893.

APPENDIX O.

ABRIDGMENT CLASSES FOR A.D. 1877-1883.

The following Classes and Appendices were issued in 1893, price NINEPENCE each :—

A.—ILLUSTRATED ABRIDGMENT CLASSES, (large octavo size).

Advertising and displaying. (Postage 1½*d.*)
Aeronautics. (Postage 1*d.*)
Agricultural appliances, Farmyard and like, [*including* the housing, feeding, and treatment of animals]. (Postage 2*d.*)
Agricultural appliances for the treatment of land and crops, [*including* Gardening-appliances]. (Parcel Postage 4½*d.*)
Air and gas engines. (Parcel postage 4½*d.*)
Air and gases, Compressing, exhausting, moving, and otherwise treating. (Parcel postage 3*d.*)
Animal-power engines and miscellaneous motors. (Postage 1½*d.*)
Artists' instruments and materials. (Postage 1*d.*)
Bells, gongs, foghorns, sirens, and whistles. (Postage 1½*d.*)
Books, [*including* Cards and card cases and the like]. (Postage 1½*d.*)
Boxes and cases, [*excepting* Trunks, portmanteaus, hand and like travelling bags, baskets, hampers, and other wickerwork]. (Postage 2*d.*)
Brushing and sweeping. (Postage 1*d.*)
Casks and barrels. (Postage 1½*d.*)
Centrifugal drying, separating, and mixing machines and apparatus. (Postage 1½*d.*)
Chains, chain cables, shackles, and swivels. (Postage 1*d.*)
Chimneys and flues, [*including* Ventilating-shaft tops]. (Postage 1*d.*)
Closets, urinals, baths, and lavatories. (Postage 2½*d.*)
Coin-freed apparatus and the like. (Postage ½*d.*)
Cooling and ice-making, [*including* Refrigerating *and* Ice-storing]. (Postage 2½*d.*)
Cutlery. (Postage 1½*d.*)
Cutting, punching, and perforating paper, leather, and fabrics, [*including* the general treatment of paper after its manufacture]. (Postage 2*d.*)
Distilling, concentrating, evaporating, and condensing liquids, [*excepting* Steam-engine condensers]. (Postage 2½*d.*)
Drains and sewers. (Postage 1½*d.*)
Drying. (Postage 2½*d.*)
Fabrics, Dressing and finishing woven and manufacturing felted, [*including* Folding, Winding, Measuring, *and* Packing]. (Postage 2½*d.*)
Fastenings, Lock, latch, bolt, and other, [*including* Safes and strong-rooms]. (Parcel postage 3*d.*)
Fencing, trellis, and wire netting. (Postage 1½*d.*)
Filtering and otherwise purifying liquids. (Postage 2*d.*)
Fire, Extinction and prevention of. (Postage 2½*d.*)
Fish and fishing. (Postage 1*d.*)
Food preparations and food-preserving. (Postage 1½*d.*)
Fuel, Manufacture of. (Postage 2*d.*)
Furnaces and kilns, [*including* Blowpipes and blowpipe burners ; Smiths' forges and rivet hearths ; Smoke and fumes, Treating]. (Parcel postage 6*d.*)
Furniture and upholstery. (Postage 4½*d.*)
Gas distribution. (Postage 1½*d.*)
Gas manufacture. (Parcel postage 3*d.*)
Governors, Speed-regulating, for engines and machinery. (Postage 2*d.*)
Grain and seeds, Treating, [*including* Flour and meal]. (Postage 2*d.*)
Hand tools and benches for the use of metal, wood, and stone workers. (Postage 2*d.*)
Harness and saddlery. (Postage 1½*d.*)
Heating, [*excepting* Furnaces *and* Stoves]. (Postage 3*d.*)
Hinges, hinge-joints, and door and gate furniture and accessories, [*excepting* Fastenings, Lock, latch, bolt, and other]. (Postage 1½*d.*)
Hollow-ware, [*including* Buckets, Pans, Kettles, Saucepans, *and* Water-cans]. (Postage 1½*d.*)
Horse-shoes. (Postage 1*d.*)
Hydraulic engineering. (Postage 2½*d.*)
Hydraulic machinery and apparatus, [*excepting* Pumps and other means for raising and forcing water]. (Parcel postage 3*d.*)
India-rubber and gutta-percha, [*including* Plastic compositions *and* Materials of constructive utility other than metals and stone]. (Postage 1½*d.*)
Injectors and ejectors. (Postage 1½*d.*)
Labels, badges, coins, tokens, and tickets. (Postage 1*d.*)
Lace-making, knitting, netting, braiding, and plaiting. (Postage 2½*d.*)
Lamps, candlesticks, gasaliers, and other illuminating apparatus, [*excepting* Electric lamps]. (Parcel postage 4½*d.*)
Leather, [*including* Treatment of hides and skins]. (Postage 1½*d.*)
Life-saving [Marine] and swimming and bathing appliances. (Postage 1*d.*)
Lifting, hauling, and loading, [*including* Lowering, Winding, *and* Unloading]. (Parcel postage 3*d.*)
Locomotives, tramway and traction engines, and portable and semi-portable engines. (Postage 3*d.*)
Mechanism and mill gearing. (Postage 4½*d.*)
Medicine, surgery, and dentistry. (Postage 2½*d.*)
Milking, churning, and cheese-making. (Postage 1*d.*)
Mining, quarrying, tunnelling, and well-sinking. (Postage 2½*d.*)
Mixing and agitating machines and appliances. (Postage 1½*d.*)
Moulding plastic and powdered substances, [*including* Bricks, building and paving blocks, and tiles, *and* Pottery]. (Parcel postage 3*d.*)
Music and musical instruments. (Postage 2*d.*)
Nails, rivets, bolts and nuts, screws, and like fastenings. (Postage 2½*d.*)
Oils, fats, lubricants, candles, and soaps. (Postage 2*d.*)
Ornamenting. (Postage 1½*d.*)
Packing and baling goods. (Postage 2*d.*)
Paints, colours, and varnishes. (Postage 1½*d.*)
Paper, pasteboard, and papier mâché. (Postage 1½*d.*)
Philosophical instruments, [*including* Optical, Nautical, Surveying, Mathematical, *and* Meteorological instruments]. (Postage 2*d.*)
Pipes, tubes, and hose. (Postage 2½*d.*)
Printing, Letterpress and lithographic. (Parcel postage 4½*d.*)
Printing other than letterpress or lithographic. (Parcel postage 3*d.*)
Pumps and other means for raising and forcing water, [*excepting* Rotary pumps]. (Postage 3*d.*)
Railway and tramway vehicles. (Parcel postage 4½*d.*)
Railways and tramways. (Parcel postage 3*d.*)
Railway signals and communicating apparatus. (Parcel postage 3*d.*)
Registering, indicating, measuring, and calculating, [*excepting* Signalling and indicating by signals]. (Parcel postage 4½*d.*)
Roads and ways. (Postage 1*d.*)
Road vehicles. (Parcel postage 3*d.*)
Ropes and cords. (Postage 1½*d.*)
Rotary engines, pumps, blowers, exhausters, and meters. (Postage 2½*d.*)
Sewage, Treatment of, [*including* Manure]. (Postage 1½*d.*)
Ships, boats, and rafts, Div. I. (Parcel postage 3*d.*)
Ships, boats, and rafts, Div. II. (Postage 3*d.*)
Ships, boats, and rafts, Div. III. (Postage 1*d.*)
Shop, publichouse, and warehouse fittings and accessories. (Postage 1*d.*)
Sifting and separating. (Postage 2½*d.*)
Signalling and indicating by signals, [*excepting* Railway signals and communicating apparatus]. (Postage 2*d.*)
Spinning, [*including* the preparation of fibrous materials, *and* the doubling of yarns and threads]. (Parcel postage 4½*d.*)
Starch, gum, size, glue, and other stiffening and adhesive materials. (Postage 1*d.*)
Steam engines, [*including* Details common to fluid-pressure engines generally]. (Parcel postage 4½*d.*)
Steam generators, [*excepting* Furnaces]. (Postage 4½*d.*)
Stone, marble, and the like, Cutting and working. (Postage 1*d.*)
Stoves, ranges, and fireplaces. (Parcel postage 3*d.*)
Sugar. (Postage 1½*d.*)
Table articles and appliances. (Postage 1*d.*)
Tea, coffee, cocoa, and like beverages. (Postage 1*d.*)
Tobacco. (Postage 2*d.*)
Toilet and hairdressing articles, and perfumery. (Postage 1*d.*)
Toys, games, and exercises. (Postage 2*d.*)
Trunks, portmanteaus, hand and like travelling bags, baskets, hampers, and other wickerwork. (Postage 1*d.*)
Umbrellas, parasols, and walking-sticks. (Postage 1½*d.*)
Valves and cocks. (Parcel postage 3*d.*)
Ventilation. (Postage 1½*d.*)
Washing and cleaning clothes, domestic articles, and buildings. (Postage 2½*d.*)
Watches, clocks, and other time-keepers. (Postage 2½*d.*)
Waterproof and similar fabrics. (Postage 1*d.*)
Weaving and woven fabrics. (Parcel postage 4½*d.*)
Weighing-apparatus. (Postage 1½*d.*)
Wheels for vehicles, [*excepting* wheels for Railway and tramway vehicles *and* Locomotives and traction engines]. (Postage 1½*d.*)
Wood and wood-working machinery. (Postage 2½*d.*)
Writing-instruments and stationery and writing accessories, [*including* Educational appliances]. (Postage 3*d.*)

B.—UNILLUSTRATED ABRIDGMENT CLASSES, (Crown octavo size).

Acids, alkalies, oxides, and salts :—
Div. I.—Acids, chlorine, sulphur, &c. (Postage 2½*d.*)

C.—ILLUSTRATED APPENDICES TO UNILLUSTRATED ABRIDGMENT CLASSES, (large octavo size).

Fire-arms &c., Div. I. (Postage ½*d.*)
Fire-arms &c., Div. II. (Postage ½*d.*)
Photography. (Postage ½*d.*)
Wearing-apparel, Div. I. (Postage ½*d.*)
Wearing-apparel, Div. II. (Postage 2*d.*)
Wearing-apparel, Div. III. (Postage ½*d.*)
Wearing-apparal, Div. IV. (Postage ½*d.*)

APPENDIX P.

Lists of Places Receiving Donations of Patent Office Works.

A.—*Places in the United Kingdom receiving a complete set of the publications of the Patent Office, including the Specifications, on condition that they shall be daily accessible to the public, for reference or for copying*, free of all charge.

Belfast (*Free Library*).
Birmingham (*Central Free Library, Ratcliffe Place*).
Bolton-le-Moors (*Public Library, Exchange Buildings*).
Bradford, Yorkshire (*Free Library*).
Brighton (*Free Library*).
Bristol (*Free Library, King Street*).
Cardiff (*Free Library and Museum*) *from* 1871.
Carlisle (*Public Free Library, Police Office*).
Derby (*Free Library and Museum*).
Dublin (*National Library of Ireland, Kildare Street*).
Dundee (*Public Library, Albert Institute*).
Glasgow (*Stirling's Library, Miller Street*).
Halifax (*Public Library, Akroyd Park*).
Horwich (*Mechanics' Institute*).
Huddersfield (*Corporation Offices*).
Hull (*Mechanics' Institute, George Street*).
Ipswich (*Museum Library, Museum Street*).
Keighley (*Mechanics' Institute, North Street*).
Kidderminster (*Free Library, Public Buildings, Vicar Street*).
Leeds (*Public Library*).
Leicester (*Free Library, Wellington Street*).
Liverpool (*Free Library, William Brown Street*).
London (*British Museum*).
(*Free Library, London Street, Bethnal Green*) *from* 1877.
Manchester (*Free Library, King Street*).
Newcastle-upon-Tyne (*Public Library, New Bridge Street*).
Newport, Monmouth (*Free Library*).
Nottingham (*Free Public Libraries*).
Oldham (*Free Library, Union Street*).
Plymouth (*Free Library*).
Preston (*Dr. Shepherd's Library, Cross Street*).
Rochdale (*Free Library, Town Hall*).
Salford (*Free Library, Peel Park*).
Sheffield (*Free Library, Surrey Street*).
Stockport (*Central Free Library*).
Swansea (*Free Library*).
Wolverhampton (*Free Library*).

B.—*Public Offices, &c., in the United Kingdom, and British Colonies and Foreign States receiving a complete set of the Publications of the Patent Office.*

Public Offices, &c.

Department of Science and Art, South Kensington.
Museum of Science and Art, Edinburgh.
Public Record Office, Dublin.

British Colonies.

Canada—Patent Office, Ottawa.
Council of Arts and Manufactures of Quebec, Montreal.
Public Library, Toronto.
India—Bengal.
Bombay.
Madras.
New South Wales.
New Zealand.
Queensland.
South Australia—Colonial Institute, Adelaide.
Patent Office, Adelaide (*from* 1878).
Tasmania.
Victoria—Patent Office, Melbourne.
Public Library, Melbourne.

Foreign States.

Austria—Polytechnic University, Vienna.
Belgium—Ministère Directeur l'Industrie, Brussels.
Musée de l'Industrie, Palais du Midi, Brussels.
France—Bibliothèque Nationale, Paris.
Bureau de la Propriété Industrielle, Ministère du Commerce, Paris (*from* 1876).
France—Conservatoire des Arts et Métiers, Paris.
Germany—Kaiserliches Patentamt, Berlin.
Kaiserliches Statistische amt, Berlin.
Baden—Polytechnic School, Carlsruhe (*from* 1876).
Bavaria—Munich—Polytechnische Verein.
Prussia—Königliche Bibliothek, Berlin.
Saxony—Polytechnische Schule, Dresden.
Mulhouse—Société Industrielle.
Italy—Ufficio delle Privative, Rome.
Royal Institution for the Encouragement of Science, Naples (*from* 1852).
Japan—Patent Office, Tokio (*from* 1884).
Russia—Bibliothèque Impériale, St. Petersburg.
Polytechnic School, Riga.
Spain—Madrid.
Sweden—Patent Office, Stockholm.
United States—Patent Office, Washington, D.C.
Astor Library, New York, N.Y.
State Library, Albany, N.Y.
Franklin Institute, Philadelphia, Pa.
Free Public Library, Boston, Mass.
Public Library, Cincinnati, Ohio.
Free Public Library, Chicago, Ill.
Peabody Institute, Baltimore, Md.
Cornell University, Ithaca, N.Y.
Mercantile Library, St. Louis, Mo.
Mechanics' Institute, San Francisco, Cal.
Historical Society, Madison, Wis.

C.—*Places in the United Kingdom receiving the Abridgments of Specifications only.*

Aberdeen (*Public Library*).
Aberystwith (*Literary and Working Men's Reading Room*).
Airdrie (*Free Public Library*).
Alloa (*Public Library*).
Alnwick (*Scientific and Mechanical Institution*).
Alton (*Mechanics' Institution*).
Armagh (*Natural History and Philosophical Society*).
Ashburton (*Ashburton Library, East Street*).
Ashby-de-la-Zouch (*Mutual Improvement Society*).
Ashton-under-Lyne (*Free Library, Town Hall*).
(*Mechanics' Institution*).
Aston, near Birmingham (*Aston Manor Public Library*).
Aylesbury (*Kingsbury Mechanics' Institute*).
Ayr (*Public Library*).
Bacup (*Mechanics' Institution*).
Banbury (*Mechanics' Institution*).
Barnsley (*Free Library*).
Barnstaple (*Literary and Scientific Institution*).
Barrow-in-Furness (*Barrow Working Men's Club and Institute*).
(*Free Public Library and Museum*).
Basingstoke (*Mechanics' Institute and Club*).
Bath (*Athenæum*).
(*People's Club and Institute*).
(*Royal Literary and Scientific Institution*).
Belfast (*Northern Law Club*).
Berkhampstead, Great (*Mechanics' Institute*).
(*Working Men's College*).
Birkenhead (*Literary and Scientific Society*).
Birmingham (*Free Library and News Room, Gosta Green*).
Blyth (*Mechanics' Institution*).
Bodmin (*Literary Institution*).
Bolton (*Mechanics' Institute*).
Bootle cum Linacre (*Free Public Library*).
Bournemouth (*Library and Reading Room*).
Bradford, Yorkshire (*Church Institute*).
(*Library and Literary Society*).
(*Mechanics' Institute*).
Braintree (*Braintree and Bocking Literary and Mechanics' Institution*).
Brigg, Lincolnshire (*Reading Society*).
Bristol (*Museum and Library, Queen's Road*).
Bromsgrove (*Literary and Mechanics' Institute*).
Burnley (*Literary Institution*).
(*Mechanics' Institution*).
Burslem (*Wedgwood Institute*).
Bury (*Athenæum*).
Bury St. Edmund's (*Athenæum*).
Calne (*Literary Institution*).
Cambridge (*Free Library, Guildhall*).
Canterbury (*Music and Library Committee*).
Carmarthen (*Literary and Scientific Institution*).
Carnarvon (*Free Library*).
Chatham (*Dockyard*).
Cheltenham (*Permanent Library*).
Chester (*City Library and Reading Room*).
Chichester (*Literary Society and Mechanics' Institute*).

Christchurch (*Working Men's Institute*).
Coalbrookdale (*Literary and Scientific Institution*).
Coggeshall (*Literary and Mechanics' Institution*).
Colchester (*Literary Institution*).
(*Young Men's Christian Association*).
Compstall (*Athenæum*).
Cork (*Free Library, Nelson's Place*).
Coventry (*Free Library*).
(*Institute*).
Crewe (*Mechanics' Institution*).
Darlington (*Public Library*).
Darwen (*Public Library*).
Deal (*Deal and Walmer Institute*).
Derby (*Mechanics' Institution*).
Devizes (*Literary and Scientific Institution*).
Devonport (*Free Public Library*).
Dewsbury (*Free Public Library*).
Diss (*Reading Room and Library*).
Doncaster (*Free Library*).
(*Young Men's Christian Association*).
Dorchester (*County Museum and Library*).
Dublin (*Trinity College*).
Dudley (*Mechanics' Institution*).
Dukinfield (*Village Library and Reading Room*).
Dumbarton (*Free Public Library*).
Dumfries (*Mechanics' Institution*).
Dunfermline (*Carnegie Free Library*).
Durham (*Mechanics' Institute*).
Ebbw Vale (*Literary and Scientific Institute*).
Eccles, near Manchester (*Provident Industrial Co-operative Society*).
Edinburgh (*Association of Science and Art*).
(*Philosophical Institution*).
(*Royal Scottish Society of Arts*).
(*Watt Institution and School of Art*).
(*Working Men's Club*).
Egham (*Institute and Public Reading Room*).
Egremont (*Workmen's Institute*).
Exeter (*Albert Memorial Museum and Free Library*).
(*Devon and Exeter Institution*).
Farnham (*Young Men's Association*).
Faversham (*Institute*).
Fowey (*Working Men's Reading Rooms*).
Frome (*Literary and Scientific Institution*).
(*Mechanics' Institution*).
Gainsborough (*Literary, Scientific, and Mechanics' Institute*).
Glasgow (*Athenæum*).
(*City Industrial Museum, Kelvingrove Park*).
(*Institution of Engineers in Scotland*).
(*Mechanics' Institution, Bath Street*).
(*Philosophical Society*).
Gloucester (*Engineering Society, Bank Buildings*).
Godmanchester (*Constitutional Club*).
Greenock (*Library, Watt Monument*).
Guernsey (*Guille-Allés Library, Market Place*).
Hadleigh (*The Reading Room*).
Halesworth (*Mechanics' Institute*).
Halifax (*Literary and Philosophical Society*).
(*Mechanics' Institute*).
Halstead (*Literary and Mechanics' Institute*).
Handsworth (*Free Public Library*).
Hanley (*Public Free Library*).
Haslingden (*Institute*).
Hastings (*Literary and Scientific Institute*).
Hayle (*Literary Institute*).
Hebden Bridge, near Todmorden (*Mechanics' Institution*).
Helston (*Reading Room and Library*).
Hemel Hempstead (*Literary and Mechanics' Institute*).
Hereford (*Natural History, Philosophical, Antiquarian, and Literary Society*).
Hertford (*Literary and Scientific Institution*).
Heywood (*Public Free Library*).
Hitchin (*Mechanics' Institute*).
Holbeck (*Mechanics' Institution*).
Holt, Norfolk (*Literary Society*).
Holywell Green (*Mechanics' Institution*).
Huddersfield (*Mechanics' Institution*).
Hull (*Church Institute*).
(*Literary, Scientific, and Mechanics' Institute*).
(*Lyceum Library*).
(*Royal Institution, Albion Street*).
(*Young People's Institute*).
Huntingdon (*Literary and Scientific Institution*)
Inverness (*The Public Library*).
Ipswich (*Working Men's College*).
Jersey (*Greffe Office*).
Kendal (*Mechanics' Institute*).
Kettering (*Church Institute, and Working Men's Club*).
Kilmarnock (*Library*).
Kingston-on-Thames (*Workmen's Club and Institute, Fairfield Road*).
Lancaster (*Mechanics' Institute and School of Science*).
Leamington (*Free Library, Bath Street*).
Lee, Kent (*Working Men's Institution*).
Leeds (*Association of Engineers*).
(*Church Institute*).
Leeds (*Leeds Library*).
(*Mechanics' Institute and Literary Society*).
(*Philosophical and Literary Society*).
(*Young Men's Christian Association*).
Leek, Staffordshire (*Literary and Mechanics' Institution*).
Leicester (*Law Society*).
Leighton Buzzard (*Working Men's Mutual Improvement Society*).
Lewes (*Fitzroy Memorial Library*).
(*School of Science and Art*).
Lincoln (*Mechanics' Institute*).
Liverpool (*Medical Institution*).
(*Polytechnic Society*).
Lockwood (*Mechanics' Institution*).
London (*Bank of England Library and Literary Association*).
(*Beaumont Institute, Mile End*).
(*Birkbeck Institution, Breams Buildings, Chancery Lane*).
(*Bow and Bromley Institute, Bow Road*).
(*Camberwell Central Library, High Street, Peckham*)
(*Free Public Library, Barking Road, Canning Town.*)
(*Free Public Library, Great Smith Street, Westminster*).
(*Guildhall Library*).
(*Hackney Working Men's Club*).
(*Imperial Institute*).
(*Incorporated Law Society, Chancery Lane*).
(*Institute of Patent Agents, Southampton Buildings, Chancery Lane*).
(*Institution of Civil Engineers, 25, Gt. George Street*).
(*Institution of Mechanical Engineers, 10, Victoria Chambers, S.W.*).
(*Inner Temple*).
(*Iron and Steel Institute*).
(*King's College*).
(*Lincoln's Inn Library.*)
(*Literary and Scientific Institution, Walworth*).
(*London Institution, Finsbury Circus*).
(*London Library, St. James'*).
(*Parkes Museum of Hygiene, Margaret Street, W.*).
(*Royal Architectural Museum and School of Art Tufton Street, Westminster*).
(*Royal Institute of British Architects, Conduit Street, Hanover Square*).
(*Royal School of Mines, &c., Jermyn Street, Piccadilly*).
(*St. James and Soho Working Men's Club, Gerrard Street, Soho*).
(*War Office, Pall Mall*).
(*Working Men's Club and Institute Union, Strand*).
Long Ditton (*Workmen's Club*),
Longwood (*Mechanics' Institution*).
Loughborough (*Public Library*).
Lowestoft (*Library and Reading Room*).
Madeley, Shropshire (*Anstice Memorial, Workmen's Club and Institute*).
Manchester (*Law Library*).
(*Literary and Philosophical Society, 36, George Street*).
(*Natural History Museum, Peter Street*).
(*Owen's College*).
(*Portico Library*).
(*Royal Exchange Library*).
Mansfield (*Mechanics', Artizans', and Apprentices' Library*).
(*Mechanics' Institute*).
(*Free Public Library*).
Marlborough (*Reading and Mutual Improvement Society*).
Mere, near Bath (*Literary Association*).
Middlesbrough (*Mechanics' Institution*).
(*Free Library*).
Middleton (*Free Library*).
Mildenhall (*Suffolk Literary Institution*).
Newbury (*Literary and Scientific Institution*).
Newcastle-upon-Tyne (*North of England Institute of Mining Engineers*).
New Mills, near Stockport (*Mechanics' Institute*).
Newport, Isle of Wight (*Young Men's Society and Reading Room*).
North Shields (*Free Library*).
Northampton (*Museum, Guildhall*).
Northwich (*Brunner Free Public Library*).
Norwich (*Free Library*).
Nottingham (*Mechanics' Institution*).
(*Subscription Library, Bromley House*).
Oldham (*Mechanics' Institution, Werneth*).
Penrith (*Free Public Library and Museum*).
Penzance (*Institute*).
(*Penzance Library*).
Perry Bar (*Institute*).
Perth (*Mechanics' Library, High Street*).
Pontypridd (*Free Library*).
Portsmouth (*Dockyard*).
(*Public Free Library*).
Preston (*Institution for the Diffusion of Knowledge*).
Reading (*Free Public Library and Museum*).

Redditch (*Literary and Scientific Institution*).
Redruth (*Redruth Institution*).
Richmond, Surrey (*Free Public Library*).
Ripon (*Mechanics' Institute and Literary Society*).
Rotherham (*Rotherham and Masbro' Literary and Mechanics Institute*).
Royston (*Institute*).
Ryde, Isle of Wight (*Young Men's Christian Association and Literary Institute*).
Saffron Waldon (*Literary and Scientific Institution*).
St. Helen's (*Public Library*).
St. Just (*Institution*).
St. Leonards (*Mechanics' Institution*).
Saltaire (*Literary Institute*).
Scarborough (*Mechanics' and Literary Institute, Vernon Place*).
Shaftesbury (*Literary Institution*).
Sheerness (*Dockyard*).
Sheffield (*Branch Free Library, Upperthorpe*).
(*Branch Free Library, Gower Street*).
(*Literary and Philosophical Society, School of Arts*).
Shepton Mallet (*Reading and Mutual Improvement Society*).
Shrewsbury (*Free Public Library*).
Sidmouth (*Mechanics' Hall*).
Skipton, Yorkshire (*Mechanics' Institute*).
Slough (*Mechanics' Institute*).
Smethwick, Staffordshire (*Library, Reading Room, and Literary Institute*).
Southampton (*Workmen's Hall*).
Southend (*Mechanics' Institute*).
South Shields (*Public Free Library*).
Southwell (*Literary Institution*).
Spalding (*Christian Young Men's Association*).
(*Mechanics' Institute*).
Stafford (*Corporation Free Library*).
Stalybridge, Cheshire (*Mechanics' Institution*).
Stamford (*Institution*).
Stockton-on-Tees (*Young Men's Christian Association*).
(*Free Library*).
Stourbridge (*Iron Works Reading Room and Library*).
(*Mechanics' Institution*).
Stowmarket (*Literary Institution*).
Stratford (*Working Men's Hall*).
Sudbury, Suffolk (*Literary and Mechanics' Institute*)
Swansea (*Royal Institution of South Wales*).
(*South Wales Institute of Engineers*).
Swindon, New (*G. W. R. Mechanics' Institution*).
Thornton, near Bradford (*Mechanics' Institute*).
Truro (*Cornwall County Library*).
(*Institution*).
(*Royal Institution of Cornwall*).
Tunbridge Wells (*Mechanics' Institution*).
Tynemouth (*Free Public Library*).
Uttoxeter (*Reading Room and Library*).
Wallingford (*Mechanics' Institute*).
Walsall (*Free Library*).
Wandsworth (*Public Library*).
Warminster (*Athenæum*).
Watford (*Public Library*).
Wednesbury (*Free Library*).
Wellingborough (*Working Men's Club*).
Wellington (*Young Men's Christian Association*).
West Bromwich (*Free Library*).
West Hartlepool (*Literary and Mechanics' Institute*).
Weston-super-Mare (*Free Public Library*).
Whaleybridge (*Mechanics' Institute*).
Whitby (*Museum*).
(*Subscription Library*).
Whitehaven (*Free Public Library*).
Whitstable (*Institute*).
Wilton (*Literary Institute*),
Wimbledon (*Free Public Library*).
Winchester (*Training College*).
Winsford (*Free Public Library*).
Witham (*Literary Institution*).
Witney (*Athenæum*).
Wolverhampton (*Law Library*).
Wolverton (*Science and Art Institute*).
Woodbridge (*Literary and Mechanics' Institute*).
Woolwich (*Ordnance Factories*).
Worcester (*Public Library and Hastings Museum*).
(*Railway Literary Institute*).
Workington (*Free Public Library and Reading Room*).

D.—*Places abroad receiving the Abridgments of Specifications only.*

Canada—Society of Civil Engineers, Montreal.
Cape of Good Hope.
Germany—Gotha—Ducal Friedenstein Collection.
Imperial and Provincial Library of the University, Strasburg.
Italy—Communal Library, Palermo.
Malta.
Mauritius.
Netherlands—Library of the Polytechnic School, Delft.
New Zealand—Athenæum and Mechanics' Institute, Dunedin.
Switzerland—Bureau International pour la Protection de la Propriété Industrielle, Berne.
Federal Polytechnic School, Zurich.
United States—American Academy of Arts and Sciences, Boston.
American Society of Civil Engineers, New York.
City Library Association, Springfield, Massachusetts.
United States—Industrial University, Champaign, Illinois
Law Association, Philadelphia.
Mercantile Library Association, San Francisco.
Minnesota Historical Society, Saint Paul, Minnesota.
Odd Fellows' Library Association, San Francisco.
Patent Office Bar Association, Washington.
Public Library, Detroit, Michigan.
Rose Polytechnic Institute, Terre Haute, Indiana.
Wabash College, Crawfordsville, Indiana.
Young Men's Christian Association, Scranton, Pennsylvania.
Engineers' Club, 1122, Girard Street, Philadelphia.
Victoria—School of Mines, Ballaarat.

E.—*Places receiving a portion of the publications of the Patent Office.*

Belfast (*The Linen Trade Board*).
Birmingham (*Mason College*).
Coventry (*Watchmakers' Association*).
Dundee (*Association of Watchmakers and Jewellers*).
Guernsey (*Public Record Office*).
Kew (*Library of the Royal Gardens*).
Leek (*The Nicholson Institute*).
Liverpool (*Chemical Laboratory, University College*).
London (*Aeronautical Society*).
(*British Horological Institute*).
(*Institute of British Carriage Manufacturers*).
London (*Institute of Electrical Engineers*).
(*Metallurgical Department, King's College*).
(*Microscopical Society*).
(*Odontological Society*).
(*Royal Society*).
(*Surveyors' Institution.*)
(*United Service Museum*).
Oxford (*Bodleian Library*).
Stony Stratford (*Church Institute*).
Woolwich (*Ordnance Committee*).

NATIONAL GALLERY, IRELAND.

REPORT

OF

THE DIRECTOR

TO THE

BOARD OF GOVERNORS AND GUARDIANS

OF THE

NATIONAL GALLERY OF IRELAND,

FOR THE YEAR 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

DUBLIN:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY ALEXANDER THOM & CO. (LIMITED).

And to be purchased, either directly or through any Bookseller, from
HODGES, FIGGIS, and Co. (Limited), 104, Grafton-street, Dublin; or
EYRE and SPOTTISWOODE, East Harding-street, Fleet-street, E.C.; or
JOHN MENZIES and Co., 12, Hanover-street, Edinburgh, and 90, West Nile-street, Glasgow.

1894.

[C.—7506.] *Price* ½*d.*

DIRECTOR'S REPORT FOR 1893.

National Gallery, Ireland,

August 2nd, 1894.

My Lords and Gentlemen,

I have to submit the following Report for 1893.

The National Gallery of Ireland was open to the public under the usual conditions from the 1st of January to the 31st December, with the exception of October, during which it was closed for cleaning, &c.

Within that period the number of visitors was :—

Free admissions,	73,366
(Of whom 21,531 entered on Sundays.)	
By payment,	1,545
Students' attendances,	1,255

The number of Catalogues sold was 429.

The number of new students admitted to copy was 42—35 ladies and 7 gentlemen.

The following pictures were purchased, at the prices appended, and approved by the Board :—

For the general collection :—

	£	*s.*	*d.*
Landscape (near Salisbury?), by John Constable,	125	0	0
Landscape in Wales, by J. D. Harding,	11	0	0
Irish Landscape, by Bartholomew Colles Watkins,	50	0	0
Classic Landscape (water-colour), by F. O. Finch,	15	0	0
Interior of a Flemish Mansion, by Nicolas Giselaer,	20	0	0
Farm House Interior, by D. Teniers,	49	7	0
Landscape with Cattle, by W. Romeijn,	36	15	0
Martyrdom of a Saint—School of Gaudenzio Ferrari,	10	0	0
Still Life, by Pieter Claesz,	40	0	0
Portrait of an Italian Gentleman, by Andrea Solario,	532	0	0
Portrait of a Gentleman—Dutch School,	105	0	0
Portrait of a Lady, by Jervas,	5	5	0
Head of a Man (pencil drawing), by Antonio Mor,	6	0	0
Study of a Child (chalk), by François Boucher,	4	0	0

For the National Portrait and Historical collection :—

	£	*s.*	*d.*
A series of Lithographs after the Cartoons of H. B. (John Doyle),	4	0	0
A miniature Portrait of Richard Lalor Shiel, by J. Haverty,	5	0	0

The following donations were received during the year :—

A Portrait of Lady Claud Hamilton, by James Swinton, was presented by the Hon. Mrs. Swinton, the widow of the painter.

A Portrait of Sir John Stevenson, Mus. Doc., was presented by the Marquis of Headfort for the Portrait Gallery.

The Robing of Esther, by Willem de Poorter, was presented by the Director.

An Interior of a Guard-room, by Pieter Potter, was presented by Mr. R. H. Millner.

The "Interior," by Pieter Codde; the "Shepherds resting at Night," by Rembrandt; and the "Portrait of a Jewish Rabbi," by Gerbrandt van den Eeckhout—were lent to the Royal Academy of Arts, for exhibition at the "Old Masters."

By your instructions I append to my report the following copy of a resolution unanimously adopted at a meeting of the Board held at the Gallery this day, the 2nd of August, 1894 :—"In adopting the Director's Report for 1893, the Governors and Guardians of the National Gallery, Ireland, again take the opportunity of pressing on Her Majesty's Government the urgent necessity for an extension of the Gallery buildings in accordance with the scheme submitted to the Treasury in November, 1892."

I am,

My Lords and Gentlemen,

Your obedient servant,

WALTER ARMSTRONG,

Director.

Printed for Her Majesty's Stationery Office,
By ALEX. THOM & Co. (Limited), 87, 88, & 89, Abbey-street, Dublin,
The Queen's Printing Office.

REPORT by the Board of Trade on their Proceedings and Business under the Weights and Measures Acts, 1878 and 1889.

In pursuance of the 33rd Section of the Weights and Measures Act, 1878, the Board of Trade make the following Report to Parliament:—

Verification of Standards.

Standards of measure and weight, as referred to in Appendix No. 1 to this Report, have been verified and issued by the Board of Trade for official use in the United Kingdom or abroad. Primary standards based on the yard and pound are also in course of verification for the use of the Imperial Government of Russia. Appendix 1.

Appendix 2.

A list of counties, cities, and boroughs, for which local standards have been verified or re-verified by the Board of Trade, or locally compared, since the date of their last Annual Report (3rd August 1893) is attached to the present Report (Appendix No. 2). By arrangements made with the Chief Officer of the Public Control Department of the London County Council, all the local standards in use within the extensive area of the Council were duly re-verified by the Standards Department in November last.

Private Bill Legislation.

In accordance with the Standing Orders of Parliament with reference to Private Bills containing provisions relating to Weights and Measures, 48 Private Bills were deposited last December for examination at the Standards Department.

Local inquiries.

The Board of Trade have, since the date of their last Report, caused local inquiries to be made with respect to the administration of the Weights and Measures Acts in the following districts:—

Berwickshire.
Chester (City).
Cumberland.
Dublin Townships.
Govan (Burgh).
Haddingtonshire.
Northumberland.
Rochdale (Borough).
Salop.
Shrewsbury (Borough).
Stirlingshire.
Sussex, East.
Wolverhampton (Borough).
York (City).

General Regulations for the guidance of Inspectors.

General Regulations have, with the approval of the Board of Trade, been made by the local authorities of the following districts for the guidance of their Inspectors of Weights and Measures in the performance of their duties:—

Govan (Burgh).
Kingstown, Ireland (Township).
Pembroke, Ireland (ditto).
West Bromwich (Borough).

Additional or amended General Regulations have also been made by the following Local Authorities:—

Cheshire.
Sheffield (City).
Somerset.
Sussex, West.

A copy of a Form of Recognizance required by Section 43 of the Act of 1878, to be entered into by an Inspector of Weights and Measures for the due performance of the duties of his office, is attached to this Report (Appendix No. 3).

Appendix 3.

Bye laws as to the sale of coal.

The following local authorities have, under Section 28 of the Act of 1889, made bye-laws (*a*) regulating the sale of coal in quantities not exceeding two hundredweight; (*b*) requiring either generally or in specified classes of cases, a weighing instrument, of a form approved by the local authority, to be carried with any vehicle in which coal is carried for sale or delivery to a purchaser; (*c*) prescribing the distance beyond which coal is not to be carried for the purpose of being weighed or re-weighed in pursuance of the Act; (*d*) fixing the fees to be paid for the use of any weighing instrument maintained by the local authority :—

ENGLAND AND WALES.

Counties:	Boroughs:
Cumberland.	Barnstable.
Denbigh.	Blackburn.
Flint.	Darlington.
Hants.	Dover.
Lancaster.	Great Grimsby.
Lincoln: Parts of Holland.	Halifax.
Pembroke.	Newcastle-under-Lyme.
Sussex, East.	Portsmouth.
Wilts.	Southampton.
Worcester.	Wenlock.
	West Bromwich.

Inspectors' annual reports.

The Model Regulations of the Board of Trade which were published on 1st January 1890, and which have been adopted generally by Local Authorities, require every Inspector to make an Annual Report to his local authority as to the inspectoral work done by him during the year; a copy of such Report having to be sent annually to the Board of Trade.

Appendix 4.

A list is attached (Appendix No. 4) of places from which copies of the inspectors' annual reports have been duly received by the Standards Department since the 3rd August 1893.

Local Stamps of Verification.

The following counties and boroughs have, since 3rd August 1893, adopted the uniform design of stamp placed on weights, measures, and weighing instruments when their accuracy has been verified by the inspector :

	Nos.
England: Truro	368
Scotland: Aberdeenshire	535, 536, 537
Govan (Burgh)	269
Wigtownshire	593

Examination of Inspectors of Weights and Measures.

For the purpose of ascertaining that the inspectors appointed by the Local Authorities have sufficient practical knowledge for the proper performance of their duties, the Board of Trade, in pursuance of Section 11 of the Act of 1889, hold periodical examinations in London, Edinburgh, Glasgow, Dublin, and other centres. During the past year 77 candidates presented themselves for examination, of whom 37 failed to obtain a certificate of qualification. The names and districts of inspectors who have passed since 3rd August 1893 are given in Appendix No. 5. Since the passing of the Act of 1889, 491 candidates have been examined, of whom 163 failed to obtain a certificate, although some of them have presented themselves a third time for examination.

Appendix 5.

Inspectors' scale-beams.

The scale-beams or balances used by local inspectors in testing trade weights have to be verified and re-verified at the Standards Department. During the past year the scale-beams used in the districts named in Appendix No. 6, have been verified. The Department observe with satisfaction that Local Authorities generally desire now to place in their inspectors' hands accurate weighing instruments of modern form.

Appendix 6.

The

The several inspectors named in Appendix No. 7 to this Report have been authorized by the Board of Trade, during the past year, to act as adjusters of weights and measures. Inspectors authorised to adjust. Appendix 7.

The Standards Department have been provided with a new set of standard metric weights of the following denominations, constructed of iridio-platinum: Metric system.

500 grammes	1 gramme.
200 „	0·5 „
200 „	0·2 „
100 „	0·2 „
50 „	0·1 „
20 „	0·05 „
20 „	0·02 „
10 „	0·02 „
5 „	0·01 „
2 „	
2 „	

The Department have also been provided with a primary standard weight of 10 grammes, which has been verified at the Bureau International des Poids et Mesures, as shown in the attached copy of the certificate of verification (Appendix No. 8). Appendix 8.

It appears from a Bulletin (No. 26, dated 5th April 1893), issued by the United States Coast and Geodetic Survey, Washington, with the approval of the Secretary of the United States Treasury (copy of which Bulletin was forwarded by the Superintendent of the Survey to the Standards Department), that in future the "International Prototype Metre and Kilogramme" (deposited at Paris) will be regarded in the United States as the fundamental standards of "Length and Mass," and that the Yard and Pound in America will be derived from these metric standards.

Board of Trade (Standards Department),
2nd August 1894.

Courtenay Boyle.

LIST OF APPENDICES.

		PAGE
Appendix, No. 1 -	List of Primary and other Standards and Instruments verified since 3rd August 1893, for Official use, or for Governments, &c. abroad -	5
Appendix, No. 2 -	List of Counties, Cities, and Boroughs, for which Local Standards have been verified or re-verified by the Board of Trade, or locally compared, since 3rd August 1893 - - - - - - - - -	8
Appendix, No. 3 -	Copy of a Form of Recognizance entered into by Inspectors of Weights and Measures for the due Performance of the duties of the office - - - - - - - - - - - - - -	10
Appendix, No. 4 -	List of Places from which Inspectors' Annual Reports have been received since 3rd August 1893 - - - - - - - - - - -	11
Appendix, No. 5 -	List of Inspectors of Weights and Measures who, since 3rd August 1893, have passed the Examination provided for by the 11th Section of the Weights and Measures Act, 1889 - - - - - - - -	14
Appendix, No. 6 -	List of Local Authorities who have sent Inspectors' Scale Beams for Examination by the Board of Trade since 3rd August 1893 - -	15
Appendix, No. 7 -	List of Inspectors authorised by the Board of Trade to adjust Weights and Measures, in pursuance of the 12th Section of the Weights and Measures Act, 1889, since 3rd August 1893 - - - - - -	17
Appendix, No. 8 -	Certificate of Verification of Primary Standard Metric Weight of 10 grammes - - - - - - - - - - - - - -	19

APPENDIX, No. 1.

LIST of PRIMARY and other STANDARDS and Instruments verified since 3rd August 1893 for Official use or for Governments and Authorities Abroad.

1. The following Primary Standards have been verified by the Department for its own use :—

Measures of capacity, bushel to ¼-gill (Portable Standards).
20 cubic feet Gasholder.

2. The following standards have been verified for official use in the United Kingdom or abroad :—

Bank of England :

Eleven sets of Decimal Troy Bullion Weights, from 500 oz. to 0·001 oz.

British Guiana :

Standard Troy Bullion Weights of—
300 oz. to 0·01 oz.

Cape Town :

Standard Weights of—
50 lb. to ½ dr.
4,000 grains to 0·01 grain.

Standard Measures of—
Gallon.
Yard.
Inch.
60 minims (pipette).

Dry Measure Gauge.

Constantinople (Her Majesty's Consul at) :

Standard Weights of—
Sovereign, full weight (123·27447 grains).
„ least current weight (122·5 grains).
½-sovereign, full weight (61·63723 grains).
„ least current weight (61·125 grains).
3 grains.
0·774 grain.
0·512 grain.

Cyprus :

Standard Weights of—
200 drams to ¼ dram.
Cyprus litre.
½ „ „
¼ „ „
22 okes to 1 oke.

Standard Measures of—
½ kilé.
Kouza.
Gallon.
Cyprus litre.
½ „ „
$\frac{1}{10}$ „ „
$\frac{1}{16}$ „ „
$\frac{1}{20}$ „ „
$\frac{1}{25}$ „ „
Quart.
Pint.
½ „
¼ „
⅛ „
Chain (66 feet).
Yard.
Pic (2 feet).

India (Madras):
Gallon to pint (5 sets).

Lancashire Sea Fishery District, Lytham (Superintendent):
Set of Standard Gauges for meshes of Fishing Nets.

Malta:
Standard Measure (steel band chain) of 66 feet.

Mauritius:
Standard Metric Measure of 19 litres, with an attached metric scale of 61 centimetres.

Melbourne:
Standard Measure of 100 feet.

Royal Mint:
Decimal Troy Bullion Weights, 500 to 0·001 oz., and standard coin weights.

Russia:
Seven measuring tapes of 100 feet.
Five measuring tapes of 60 feet.

Selangor:
Standard Weights of—
Hundredweight.
Pound.
Ounce.
Dram.

Standard Measures of—
Gallon.
Quart to gill.
Yard.

South Africa, Gesondheid's Comité, Johannesburg:
Standard Troy Bullion Weights of:—
500 oz. to 0·001 oz.

Standard Measures of—
5 gallons to pint.
Imperial yard.
Rynland yard (37·07 in.).

Straits Settlements:
Standard Measures of—
1 gill, ½ gill, and ¼ gill.

3. Gas-measuring Instruments have been Verified since 3rd August 1893 for the undermentioned Authorities and Companies.

Aberdeen City.
Ashton-under-Lyne Borough.
Barking Gas Company.
Belfast Corporation.
Berwick and Tweedmouth Gas Light Company.
Bideford Gas and Coke Company.
Blackburn Borough.
Blackpool Corporation.
Bognor Gas Light and Coke Company.
Cork Gas Consumers' Company.
Coventry Corporation.
Crystal Palace District Gas Company.
Derby Borough.
Dundee Gas Commissioners.
Falkirk Gas Company.
Great Eastern Railway Company (Stratford).
Hamilton Corporation.
Hammersmith Vestry.
Ilfracombe Gas Company.
Lincoln City.
Littlehampton Gas Company.
Llanfairfechan and Aber Gas Undertaking.
London County Council.
Lynn Borough.
Manchester City.
Middlesbrough Corporation.
Newcastle-on-Tyne City.
New Swindon Gas Company.
Northampton Borough.
Northampton Gas Company.
Nottingham Corporation.
Paisley Corporation.
Plymouth Corporation.
Plymouth and Stonehouse Gas Company.
Preston Borough.
Salford Borough.
San Paulo Gas Company, Brazil.
Scarborough Borough.
Sligo Gas Light and Coke Company.
Southampton Borough.
Southend Gas Company.
Staines and Egham District Gas and Coke Company.
Swindon Gas and Coke Company.
Sydney Gas Company.
Wallasey Local Board.
Wigan Borough.

APPENDIX, No. 2.

LIST of COUNTIES, CITIES, and BOROUGHS for which LOCAL STANDARDS have been Verified or Re-verified by the BOARD OF TRADE, or locally compared, since 3rd August 1893.

(*a*) Verified or Re-verified by the BOARD OF TRADE.

COUNTIES.

ENGLAND:

- Bedford.
- Buckingham.
- Cambridge.
- Cornwall.
- Cumberland.
- Derby.
- Devon.
- Dorset.
- Durham.
- Essex.
- Gloucester.
- Hants.
- Hereford.
- Hertford.
- Isle of Ely.
- Kent.
- Lancaster.
- Leicester.
- Lincoln: Kesteven Division.
- London.
- Monmouth.
- Norfolk.
- Northampton.
- Northumberland.
- Oxford.
- Rutland.

ENGLAND—*continued.*

- Somerset.
- Stafford.
- Sussex, East.
- Westmorland.
- Wilts.
- Worcester.
- York, North Riding.
- York, West Riding.

WALES:

- Brecon.

SCOTLAND:

- Dumfries.
- Renfrew.

IRELAND:

- Carlow.
- Donegal.
- Kerry.
- Kildare.
- Kilkenny.
- Londonderry
- Meath.

LIST of Counties, &c. for which Local Standards have been Verified, &c.—*continued.*

CITIES AND BOROUGHS.

ENGLAND:

Ashton-under-Lyne.
Barnstaple.
Birkenhead.
Birmingham.
Blackburn.
Bournemouth.
Bristol.
Burnley.
Carlisle.
Clitheroe.
Congleton.
Coventry.
Croydon.
Darlington.
Derby.
Devonport.
Dewsbury.
Doncaster.
Dover.
Gloucester.
Great Yarmouth.
Guildford.
Halifax.
Huddersfield.
Kendal.
Leicester.
Lincoln.
Liverpool.

ENGLAND—*continued.*

Luton.
Manchester.
Newcastle-on-Tyne.
Newcastle-under-Lyme.
Norfolk.
Northampton.
Oldham.
Portsmouth.
Rochdale.
Salford.
Sheffield.
Stafford.
Stalybridge.
Tynemouth.
Wakefield.
Wigan.
Winchester.
Windsor.

WALES:

Cardiff.

SCOTLAND:

Aberdeen.
Dunbar.
Govan.

(*b*) Locally compared by Local Authorities and Comparison approved by the BOARD OF TRADE.

ENGLAND.

COUNTIES:

Devon.
Essex.
York, West Riding.

APPENDIX, No. 3.

COPY of a form of Recognizance entered into by Inspectors of Weights and Measures for the due performance of the duties of the office.

to wit

BE IT REMEMBERED, that on the day of One Thousand Eight Hundred and , of number Street, in the of in the of Inspector of Weights and Measures, personally came before me Esq., one of Her Majesty's Justices of the Peace for the said of , and acknowledged himself to owe to our Sovereign Lady the Queen the sum of of good and lawful money of Great Britain, to be made and levied of his goods and chattels, lands and tenements, to the use of our said Lady the Queen, her heirs and successors, if he the said shall fail in the condition hereunder written.

THE CONDITION of this recognizance is such that if the above bounden shall duly perform the duties of the office of Inspector of Weights and Measures for the of , in the of and shall duly pay at the times fixed (or to be fixed) by the local authority of the said of all fees received by him under the Weights and Measures Act, 1878, and the Weights and Measures Act, 1889, and shall keep in safety the local standards and the stamps, and appliances for verification committed to his charge, and shall duly surrender them immediately on his removal or other cessation from office to the person appointed by the said local authority to receive them, then this recognizance to be void, otherwise to remain in full force.

TAKEN and acknowledged, the day and year first above-mentioned, at in the said of before me, the undersigned, one of Her Majesty's Justices of the Peace for the said

APPENDIX, No. 4.

LIST of PLACES from which INSPECTORS' ANNUAL REPORTS have been received since 3rd August 1893.

Aberdeen, County.
Aberdeen, City.
Accrington.
Airdrie.
Anglesea, County.
Anstruther.
Argyll, County.
Ashton-under-Lyne.
Ayr, County.
Ayr, Burgh.
Bacup.
Banbury.
Barnstaple.
Barrow-in-Furness.
Bath.
Batley.
Bedford, County.
Bedford, Borough.
Berwick-on-Tweed.
Beverley.
Birkenhead.
Birmingham.
Blackburn.
Blackpool.
Bolton.
Bootle.
Boston.
Bournemouth.
Bradford.
Brecon, County.
Bridgwater.
Bristol.
Bucks.
Bury.
Buteshire.
Cambridge, County.
Cambridge, Borough.
Campbeltown.
Canterbury.
Cardiff.
Cardigan, County.
Carlisle.
Carmarthen, County.
Carmarthen, Borough.
Carnarvon, County.
Chepping Wycombe.
Cheshire.
Chester.
Chesterfield.
Clitheroe.
Coatbridge
Colchester.
Congleton.
Cornwall.
Coventry.
Crewe.
Croydon.
Cumberland.
Dalkey, Township.
Darlington.
Denbigh, County.
Derby, County.
Derby, Borough.
Devonport.
Devonshire.
Doncaster.
Dorset.
Dover.
Dublin, City.
Dumfries, County.
Dunbarton, Burgh.
Dunfermline.
Durham, County.
Durham, City.
Edinburgh, County.
Edinburgh, City.
Elgin, County.
Ely, Isle of.
Essex.
Falkirk.
Fife, County.
Folkestone.
Forfar, County.
Forres.
Galashiels.
Gateshead.
Glasgow.
Gloucester, County.

LIST of Places from which Inspectors' Annual Reports have been received since 3rd August 1893—*continued.*

Gloucester, City.
Grantham.
Gravesend.
Great Grimsby.
Great Yarmouth.
Guildford.
Halifax.
Hamilton.
Hanley.
Hants.
Hartlepool.
Hastings.
Hawick.
Hereford, County.
Hereford, City.
Hertford, County.
Huddersfield.
Hull.
Huntingdon, County.
Inverkeithing.
Inverness, County.
Inverness, Burgh.
Ipswich.
Irvine, Burgh.
Isle of Wight.

Kendal.
Kidderminster.
Kilmarnock.
Kincardine, County.
King's Lynn.
Kinross, County.
Kirkcudbright, County.

Lanark, County.
Lancaster, County.
Lancaster, Borough.
Leamington.
Leeds.
Leicester, County.
Leicester, Borough.
Leith.
Lincoln, County.
Lincoln, City.
Linlithgow, County.
Liverpool.
London, County.
London, City.
Louth.
Luton.

Macclesfield.
Maidstone.
Manchester.
Merioneth, County.
Middlesbrough.
Middlesex.
Monmouth, County.
Montgomery, County.
Montrose, Burgh.
Morley.
Nairn, County.
Nairn, Burgh.
Neath.
Newark.
Newbury.
Newcastle-on-Tyne.
Newport (Monmouthshire).
Norfolk.
Northampton, Borough.
Northumberland.
Nottingham, County.
Nottingham, Borough.
Oban.
Oldham.
Oxford, County.
Oxford, City.
Peebles, County.
Penzance.
Perth, County.
Peterborough, City.
Peterborough, Soke of.
Plymouth.
Portsmouth.
Rathmines and Rathgar, Township.
Reading.
Renfrew, County.
Renfrew, Burgh.
Rochdale.
Rochester.
Ross and Cromarty, County.
Rotherham.
Rothesay.
Roxburgh, County.
Rutland, County.
St. Andrews.
St. Helens.
Salford.
Selkirk, County.
Sheffield.
Somerset.
Southampton.
Southport.
South Shields.
Stafford, County.
Stafford, Borough.
Stalybridge.

LIST of Places from which Inspectors' Annual Reports have been received since 3rd August 1893—*continued.*

Stirling, County.
Stockport.
Suffolk, East.
Suffolk, West.
Sunderland.
Surrey.
Sussex, East.
Sutherland, County.
Swansea.
Tiverton.
Tunbridge Wells.
Tynemouth.
Wakefield.
Walsall.
Wenlock.
West Ham.
Westmorland.
Wigtown, County.
Winchester.
Windsor.
Wolverhampton.
Worcester, City.
York, West Riding.
York, City.
Zetland.

APPENDIX, No. 5.

LIST of INSPECTORS of WEIGHTS and MEASURES who, since 3rd August 1893, have passed the Examination provided for by the 11th Section of the WEIGHTS AND MEASURES ACT, 1889.

Bolshaw, Frederick Percy	Scarborough.
Carter, Roger James	Rochdale.
Collins, M. J. (Royal Irish Constabulary)	Ireland.
Cormick, Patrick (Royal Irish Constabulary)	ditto.
Cox, Henry Pilbeam	Berkshire.
Danby, John Wiliam	Rotherham, Borough.
Davies, John Ivor	Flintshire.
Devaney, James (Royal Irish Constabulary)	Ireland.
Farndale, Joseph	Margate.
Foster, John (Royal Irish Constabulary)	Ireland.
Frizelle, George (Royal Irish Constabulary)	ditto.
Frost, William	Rochdale, Borough (District No. 2).
Hobcroft, Edward (Royal Irish Constabulary)	Ireland.
Jones, John Clarke	Denbighshire.
Laver, Harry	Essex.
Mallon, Bernard (Royal Irish Constabulary)	Ireland.
Marsh, Charles Henry Cromwell	Borough of Dover and Liberties of Ringwold.
May, T. (Royal Irish Constabulary)	Ireland.
McGrath, Francis (Royal Irish Constabulary)	ditto.
McKiernan, John (Royal Irish Constabulary)	ditto.
McMahon, Luke (Royal Irish Constabulary)	ditto.
McNally, Walter (Royal Irish Constabulary)	ditto.
Mooney, Patrick (Royal Irish Constabulary)	ditto.
O'Leary, John (Royal Irish Constabulary)	ditto.
Orr, James (Royal Irish Constabulary)	ditto.
Park, James K. (Royal Irish Constabulary)	ditto.
Philip, Mark	Coatbridge.
Price, Noah	Denbighshire (Wrexham District).
Quinn, James (Royal Irish Constabulary)	Ireland.
Reilly, Terence (Royal Irish Constabulary)	ditto.
Robertson, Robert	Aberdeen, City.
Robinson, Albert	Kingston-upon-Hull.
Shaw, William	Banffshire and Burghs of Banff and Cullen.
Sheahan, Patrick (Royal Irish Constabulary)	Ireland.
Sheridan, Robert (Royal Irish Constabulary)	ditto.
St. John, John (Royal Irish Constabulary)	ditto.
Sullivan, John (Royal Irish Constabulary)	ditto.
Tough, James Macgillivray	Northumberland.
Van Tromp, Harold Humphries	South Staffordshire.
Weddell, John	Northumberland.

APPENDIX, No. 6.

LIST of LOCAL AUTHORITIES who have sent Inspectors' Scale Beams for Examination by the BOARD OF TRADE since 3rd August 1893.

COUNTIES.

ENGLAND:

Bedford.
Cambridge.
Cumberland.
Durham.
Hants.
Hertford.
Lancaster.
London.
Norfolk.
Northampton.
Northumberland.
Nottingham.
Rutland.
Somerset.
Suffolk, East.
Sussex, East.
Sussex, West.
Wilts.
York, West Riding.

WALES:

Denbigh.
Glamorgan.

SCOTLAND:

Berwick.
Perth.
Zetland.

IRELAND:

Cork, East Riding.
Dublin.
Londonderry.

List of Local Authorities who have sent Inspectors' Scale Beams, &c.—*continued.*

CITIES AND BOROUGHS.

ENGLAND:

- Birmingham.
- Bootle.
- Bradford.
- Carlisle.
- Chesterfield.
- Clitheroe.
- Dewsbury.
- Dover.
- Folkestone.
- Gloucester.
- Guildford.
- Huddersfield.
- Hull.
- Leeds.
- Lincoln.
- Liverpool.
- Manchester.
- Newcastle-on Tyne.
- Newcastle-under-Lyme.
- Oldham.

ENGLAND—*continued.*

- Reading.
- Rochdale.
- Sheffield.
- Southampton.
- Winchester.
- Wolverhampton.

WALES:

- Cardiff.

SCOTLAND:

- Dunbar.
- Govan.

IRELAND:

- Pembroke, Township.

APPENDIX, No. 7.

LIST of INSPECTORS authorised by the BOARD OF TRADE to adjust WEIGHTS and MEASURES, in pursuance of the 12th Section of the Weights and Measures Act, 1889; since 3rd August 1893.

NAME.	DISTRICT.		PERIOD OF AUTHORISATION.
Aldersey, T., Junior	Salop	County	Permanent.
Ball, A. E.	Worcester	County	30 June 1895.
Barham, J. W.	Louth	Borough	31 December 1894.
Bolton, J. D.	Flint	County	31 December 1894.
Breeze, A.	Montgomery	County	31 March 1895.
Bradley, J.	Lincoln	City	Permanent.
Bridger, W.	Sussex, West	County	- ditto.
Brooks, C.	Sussex, West	County	- ditto.
Buck, C.	Rochdale	Borough	- ditto.
Burton, H.	Dudley	Borough	1 June 1894.
Cameron, J.	Argyll	County	31 December 1894.
	Oban	Burgh	31 December 1894.
Catchpole, G. W.	Sheffield	City	Permanent.
Clark, W.	Renfrew	County	30 June 1895.
	Kinning Park	Burgh	30 June 1895.
Clarke, R. B.	Sussex, West	County	Permanent.
Clarke, W. W.	Birkenhead, Mersey Docks	Borough	- ditto.
	Cheshire, Mersey Docks	County	- ditto.
Clayton, W.	Clitheroe	Borough	31 December 1894.
Clowes, S.	Northampton	County	31 December 1894.
Crabtree, W. H. S.	York (West Riding)	County	31 March 1895.
Critchley, D. C.	Worcester	County	30 June 1895.
Cross, F.	Sussex, West	County	Permanent.
Davies, R. D.	Anglesey	County	31 December 1894.
Denman, R.	Sussex, West	County	Permanent.
Denton, W. T.	Newcastle-on-Tyne	City	- ditto.
Ellis, H.	Sussex, West	County	- ditto.
Ewen, D.	Sussex, West	County	- ditto.
Fleming, P.	Linlithgow	County	- ditto.
Ford, J.	Sussex, West	County	- ditto.
Fox, W. F.	Southport	Borough	31 December 1894.
Garforth, G. E.	Nottingham	County	31 May 1895.
Gray, W.	Dunbarton	County	Permanent.
Henderson, J.	Dunbarton	Burgh	31 December 1894.
Holdaway, A. E.	Winchester	City	Permanent.
Hughes, D.	Flint	County	31 December 1894.
Jackson, J.	Burnley	Borough	31 July 1894.
Jeffery, W.	Worcester	County	30 June 1895.
Jones, J.	Anglesey	County	31 December 1894.
Jones, J. C.	Denbigh	County	Permanent.
Kennet, J.	Sussex, West	County	- ditto.
Lea, T.	Wigan	Borough	- ditto.
Long, J.	Sussex, West	County	- ditto.
Mackay, P.	Dumbarton	County	- ditto.
Mackinnon, R.	Govan	Burgh	- ditto.

LIST OF INSPECTORS authorised by the Board of Trade to adjust WEIGHTS and MEASURES in pursuance of the 12th Section of the Weights and Measures Act, 1889; since 3rd August 1893—*continued.*

NAME.	District.		Period of Authorisation.
MacNab, J.	Bute	County	31 December 1894.
	Rothesay	Burgh	31 December 1894.
McHardy, C.	Dunbarton	County	Permanent.
McIntyre, T.	Dunbarton	County	- ditto.
Major, T. C.	Cardiff	Borough	- ditto.
Malcolm, R. G.	Pembroke	Township	- ditto.
Mattinson, T.	Northampton	County	31 December 1894.
Moir, C.	Berwick	County	30 June, 1895.
Moody, A.	Dunbar	Burgh	1 June 1894.
Murray, D.	Dunbarton	County	Permanent.
Newbould, H.	York (West Riding)	County	- ditto.
Nicholas, R.	Penzance	Borough	30 June 1895.
Oliphant, J.	Montrose	Burgh	31 December 1894.
Owen, G.	Cardiff	Borough	Permanent.
Pirie, J.	Elgin	County	31 December 1895.
	Elgin	Burgh	31 December 1895.
Porter, A.	Berwick	County	30 June 1895.
Price, N.	Denbigh	County	Permanent.
Pugh, A.	Worcester	County	30 June 1895.
Read, H.	Sussex, West	County	Permanent.
Robertson, J.	Sussex, West	County	- ditto.
Sandys, H. Stair	Derby	County	- ditto.
Scott, W.	Perth	County	30 September 1894.
Seed, J.	York (West Riding)	County	31 March 1894.
Shaw, W.	Banff	County	31 December 1894.
Shortt, W. A.	Derby	County	Permanent.
Skelton, W.	Great Grimsby	Borough	31 December 1894.
Slough, A. E.	Luton	Borough	31 December 1894.
Speight, J.	Wakefield	City	31 December 1894.
Symonds, E. J.	Salop	County	Permanent.
	Wenlock	Borough	- ditto.
Thompson, M. A.	Berwick-on-Tweed	Borough	31 December 1894.
Turner, D. H.	Dewsbury	Borough	Permanent.
Varley, A.	York (West Riding)	County	- ditto.
Walters, H. C.	Suffolk, West	County	30 April 1895.
Wasley, J.	Worcester	County	30 June 1895.
Welch, J. S.	Folkestone	Borough	Permanent.
Wheeler, J.	Worcester	County	30 June 1895.
White, H.	Sussex, West	County	Permanent.
Wright, J.	Dunbarton	County	- ditto.

Appendix, No. 8.

Certificate of Verification of Primary Standard Metric Weight of 10 grammes.

Certificat d'une Masse de 10 grammes en platine iridié, appartenant au Board of Trade, Standards Department, reçue le 26 Août 1892, avec demande d'en déterminer la masse.

Description.

Cette masse a la forme d'un petit cylindre et porte une rainure circulaire dans le milieu de sa hauteur ; elle est désignée par le symbole " Ch " dans les cahiers d'observations du Bureau International.

Etude.

L'étude du décagramme " Ch " a été effectuée, à la fin de Septembre 1892, par M. le Dr. R. Benoît, Directeur du Bureau International.

On a admis que la densité du métal constituant cette pièce est la même que celle des masses en platine iridié auxquelles elle a été comparée, savoir :

21·519.

Le volume qui en résulte est

$$\text{Vol.}_{(Ch)} = 0{\cdot}4647 \text{ ml.}$$

La masse du décagramme " Ch " a été déterminée par deux groupes indépendants de comparaisons faites entre " Ch " d'une part, et d'autre part deux pièces de 10 grammes appartenant aux Séries " O " et " Oe " du Bureau International.

On a trouvé, tous calculs faits :

$$\text{Masse}_{(Ch)} = 9{\cdot}999127 \text{ g}.$$

En tenant compte des diverses causes d'erreurs on peut attribuer à ce résultat l'erreur probable de $\pm$ 0·01 mg.

Le décagramme a été remis le 10 Janvier 1893, à l'Ambassade d'Angleterre à Paris.

Bureau International des Poids et Mesures,
Pavillon de Breteuil, Sèvres (S. et-O),
27 Janvier 1893.

WEIGHTS AND MEASURES.

REPORT by the Board of Trade on their Proceedings and Business under the Weights and Measures Acts, 1878 and 1889.

(Presented pursuant to Act of Parliament.)

Ordered, by The House of Commons, *to be Printed,*
2 *August* 1894.

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